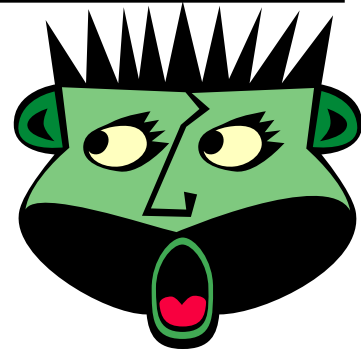


The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION



PHYSICAL SETTING EARTH SCIENCE

Tuesday, June 19, 2007 — 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 *Earth Science Reference Tables*. The *Earth Science Reference Tables* are supplied separately. Be certain you have a copy of the *2001 Edition (Revised November 2006)* of these reference tables before you begin the examination.

Your answer sheet for Part A and Part B–1 is the last page of this examination booklet. Turn to the last page and fold it along the perforations. Then, slowly and carefully, tear off your answer sheet and fill in the heading.

The answers to the questions in Part B–2 and Part C 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. Record your answers to the Part A and Part B–1 multiple-choice questions on your separate answer sheet. Write your answers to the Part B–2 and Part C questions in your answer 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 on your separate answer sheet and in your answer booklet.

When you have completed the examination, you must sign the statement printed at the end of 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 *2001 Earth Science Reference Tables (Revised November 2006)* 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 on your separate answer sheet 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 *Earth Science Reference Tables*.

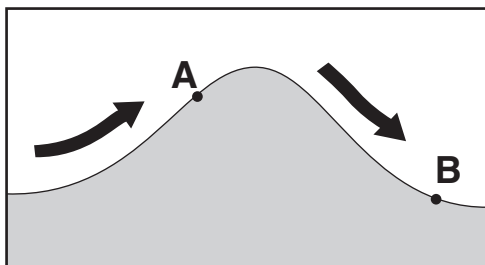
1 The best evidence that Earth spins on its axis is the motion of

- (1) tectonic plates
- (2) *Polaris*
- (3) a wind vane
- (4) a Foucault pendulum

2 When viewed from Earth, the light from very distant galaxies shows a red shift. This is evidence that these distant galaxies are

- (1) revolving around the Sun
- (2) revolving around the Milky Way
- (3) moving away from Earth
- (4) moving toward Earth

3 The arrows on the cross section below show the prevailing wind that flows over a mountain. Points *A* and *B* represent locations on opposite sides of the mountain.



Which statement correctly describes the differences in the climates of locations *A* and *B*?

- (1) Location *A* is warmer and drier than location *B*.
- (2) Location *A* is cooler and wetter than location *B*.
- (3) Location *B* is warmer and wetter than location *A*.
- (4) Location *B* is cooler and drier than location *A*.

4 The average temperature at Earth's equator is higher than the average temperature at Earth's South Pole because the South Pole

- (1) receives less intense insolation
- (2) receives more infrared radiation
- (3) has less land area
- (4) has more cloud cover

5 Which statement best summarizes the general effects of ocean currents at 20° S latitude on coastal regions of South America?

- (1) The east coast and west coast are both warmed.
- (2) The east coast and west coast are both cooled.
- (3) The east coast is warmed and the west coast is cooled.
- (4) The east coast is cooled and the west coast is warmed.

6 Which type of electromagnetic energy has the longest wavelength?

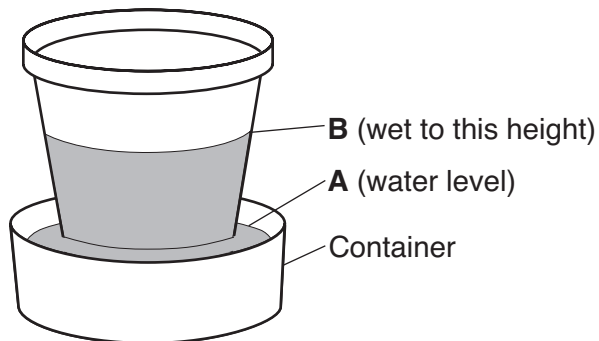
- (1) infrared radiation
- (2) radio wave radiation
- (3) ultraviolet radiation
- (4) x-ray radiation

7 Under which atmospheric conditions will water most likely evaporate at the fastest rate?

- (1) hot, humid, and calm
- (2) hot, dry, and windy
- (3) cold, humid, and windy
- (4) cold, dry, and calm

- 8 Which temperature zone of Earth's atmosphere contains the most water vapor?
- (1) mesosphere (3) thermosphere
 (2) stratosphere (4) troposphere

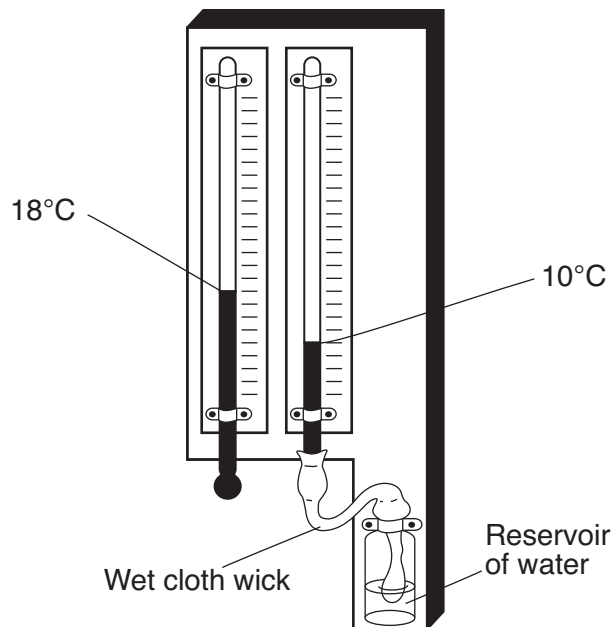
- 9 The diagram below shows the result of leaving an empty, dry clay flowerpot in a full container of water for a period of time. The water level in the container dropped to level A. The top of the wet area moved to level B.



Level B is higher than level A because water

- (1) is less dense than the clay pot
 (2) is more dense than the clay pot
 (3) traveled upward in the clay pot by capillary action
 (4) traveled downward in the clay pot by capillary action
- 10 Which weather condition most directly determines wind speeds at Earth's surface?
- (1) visibility changes
 (2) amount of cloud cover
 (3) air-pressure gradient
 (4) dewpoint differences
- 11 Which statement best explains why an increase in the relative humidity of a parcel of air generally increases the chance of precipitation?
- (1) The dewpoint is farther from the condensation point, causing rain.
 (2) The air temperature is closer to the dewpoint, making cloud formation more likely.
 (3) The amount of moisture in the air is greater, making the air heavier.
 (4) The specific heat of the moist air is greater than the drier air, releasing energy.

- 12 The two elements that make up the largest percentage by mass of Earth's crust are oxygen and
- (1) silicon (3) hydrogen
 (2) potassium (4) nitrogen
- 13 The weather instrument below can be used to determine relative humidity.



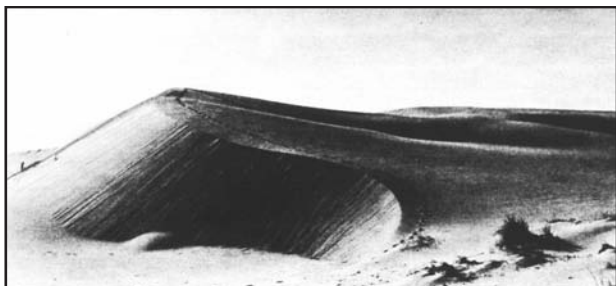
Based on the temperatures shown, the relative humidity is

- (1) 19% (3) 33%
 (2) 2% (4) 40%
- 14 Which two minerals have cleavage planes at right angles?
- (1) biotite mica and muscovite mica
 (2) sulfur and amphibole
 (3) quartz and calcite
 (4) halite and pyroxene
- 15 Which property would best distinguish sediment deposited by a river from sediment deposited by a glacier?
- (1) mineral composition of the sediment
 (2) amount of sediment sorting
 (3) thickness of sediment layers
 (4) age of fossils found in the sediment

16 Salt deposits are found in the surface bedrock near which New York State location?

- (1) Oswego
- (2) Syracuse
- (3) Old Forge
- (4) Albany

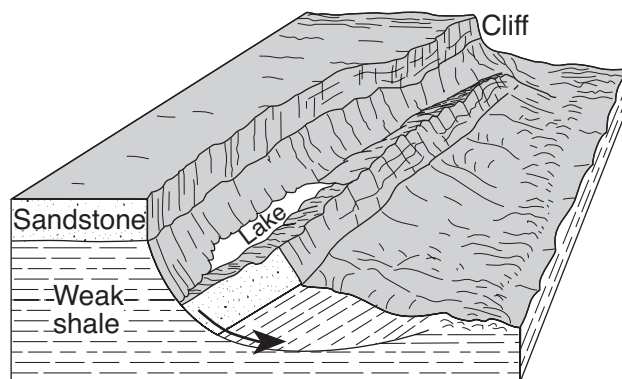
17 The photograph below shows a sand dune that formed in a coastal area.



This sand dune was most likely formed by

- (1) water flowing from the left
 - (2) water flowing from the right
 - (3) wind blowing from the left
 - (4) wind blowing from the right
- 18 What is the origin of fine-grained igneous rock?
- (1) lava that cooled slowly on Earth's surface
 - (2) lava that cooled quickly on Earth's surface
 - (3) silt that settled slowly in ocean water
 - (4) silt that settled quickly in ocean water
- 19 Why does the oceanic crust sink beneath the continental crust at a subduction boundary?
- (1) The oceanic crust has a greater density.
 - (2) The oceanic crust is pulled downward by Earth's magnetic field.
 - (3) The continental crust has a more mafic composition.
 - (4) The continental crust is pulled upward by the Moon's gravity.
- 20 Based on fossil evidence, most scientists infer that
- (1) life has not changed significantly throughout Earth's history
 - (2) life has evolved from complex to simple forms
 - (3) many organisms that lived on Earth have become extinct
 - (4) mammals developed early in the Precambrian time period




21 The block diagram below shows a displacement of rock layers.



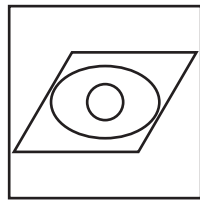
Which process describes the downward sliding of the rock material?

- (1) tidal changes
 - (2) glacial erosion
 - (3) mass movement
 - (4) lava flow
- 22 The presence of which index fossil in the surface bedrock most likely indicates that a forest environment once existed in the region?
- (1) *Aneurophyton*
 - (2) *Cystiphyllum*
 - (3) *Centroceras*
 - (4) *Bothriolepis*
- 23 Which two types of rock are most commonly found as outcrops in New York State's Newark Lowlands landscape region?
- (1) rock salt and gypsum
 - (2) limestone and granite
 - (3) gneiss and quartzite
 - (4) conglomerate and sandstone
- 24 Which processes most likely formed the shale bedrock found near Ithaca, New York?
- (1) uplift and solidification
 - (2) burial and compaction
 - (3) heat and pressure
 - (4) melting and recrystallization

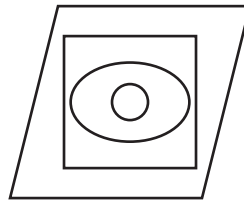
25 The symbols below are used to represent different regions of space.

Universe =  Earth =  Galaxy =  Solar system = 

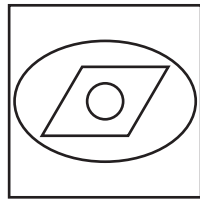
Which diagram shows the correct relationship between these four regions? [If one symbol is within another symbol, that means it is part of, or included in, that symbol.]



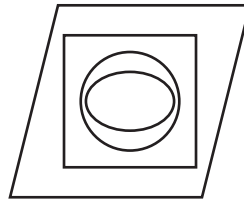
(1)



(3)

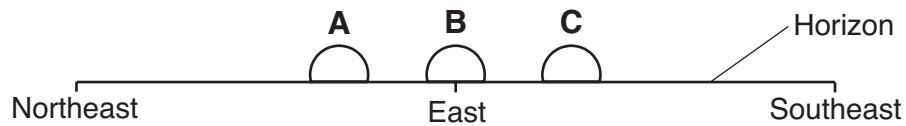


(2)



(4)

26 A student in New York State looked toward the eastern horizon to observe sunrise at three different times during the year. The student drew the following diagram that shows the positions of sunrise, A, B, and C, during this one-year period.



Which list correctly pairs the location of sunrise to the time of the year?

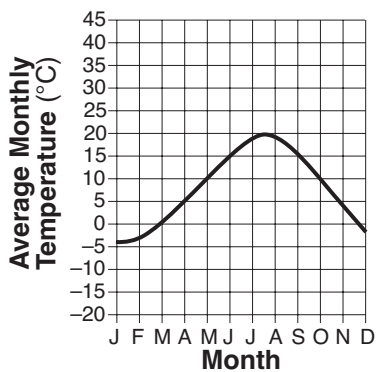
- (1) A—June 21
B—March 21
C—December 21

- (3) A—March 21
B—June 21
C—December 21

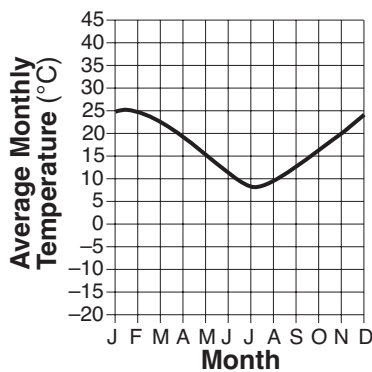
- (2) A—December 21
B—March 21
C—June 21

- (4) A—June 21
B—December 21
C—March 21

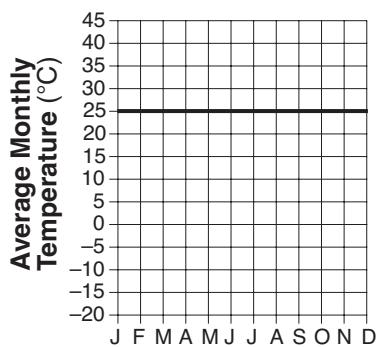
27 Which graph best represents the average monthly temperatures for one year at a location in the Southern Hemisphere?



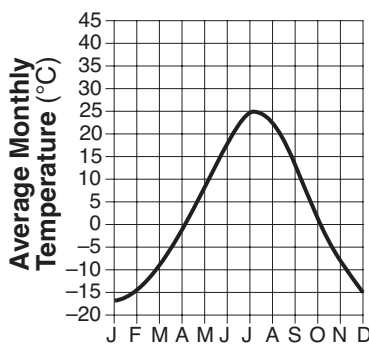
(1)



(3)

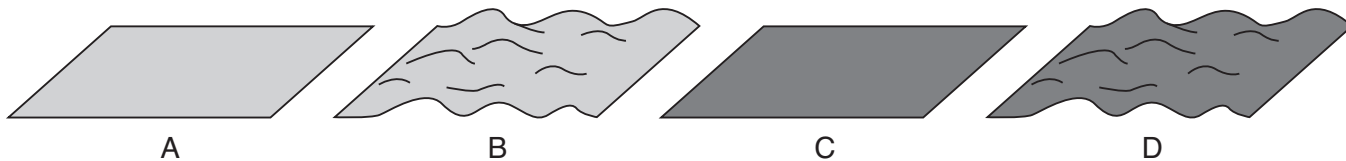


(2)



(4)

28 The diagram below shows four surfaces of equal area that absorb insolation.

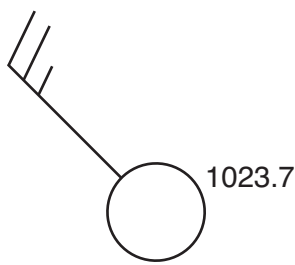


Which letter represents the surface that most likely absorbs the greatest amount of insolation?

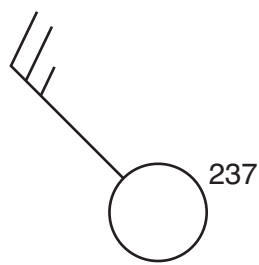
- (1) A
- (2) B

- (3) C
- (4) D

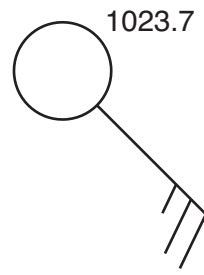
29 Which station model shows the correct form for indicating a northwest wind at 25 knots and an air pressure of 1023.7 mb?



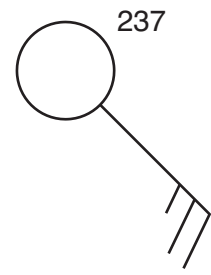
(1)



(2)



(3)



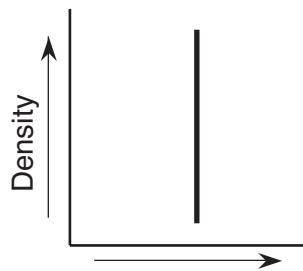
(4)

30 The data table below shows the mass and volume of three samples of the same mineral. [The density column is provided for student use.]

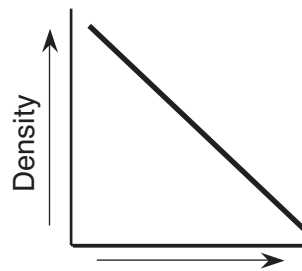
Data Table

Sample	Mass (g)	Volume (cm ³)	Density (g/cm ³)
A	50	25	
B	100	50	
C	150	75	

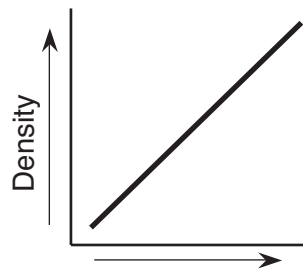
Which graph best represents the relationship between the density and the volume of these mineral samples?



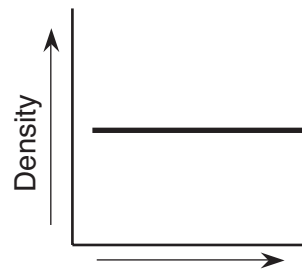
(1)



(3)

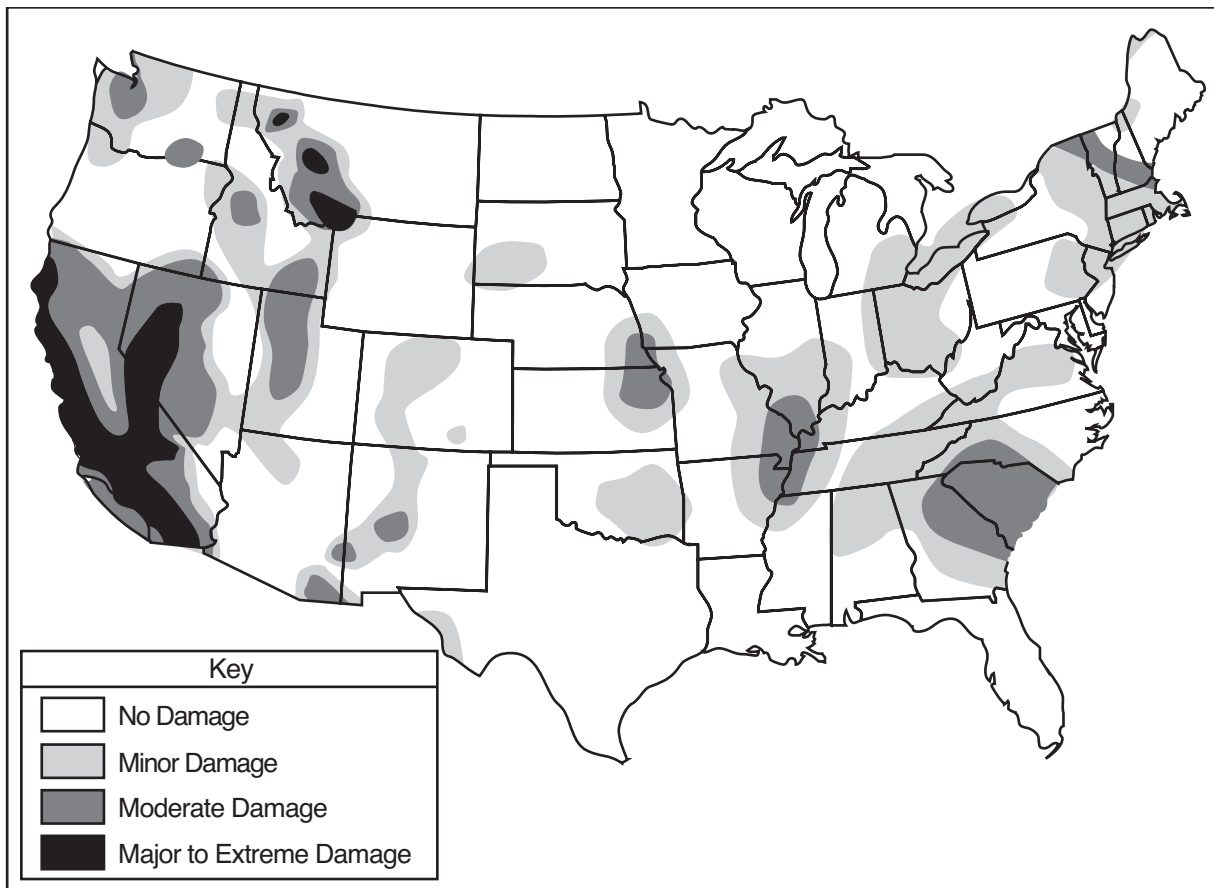


(2)



(4)

Base your answers to questions 31 and 32 on the map below, which shows the risk of damage from seismic activity in the United States.



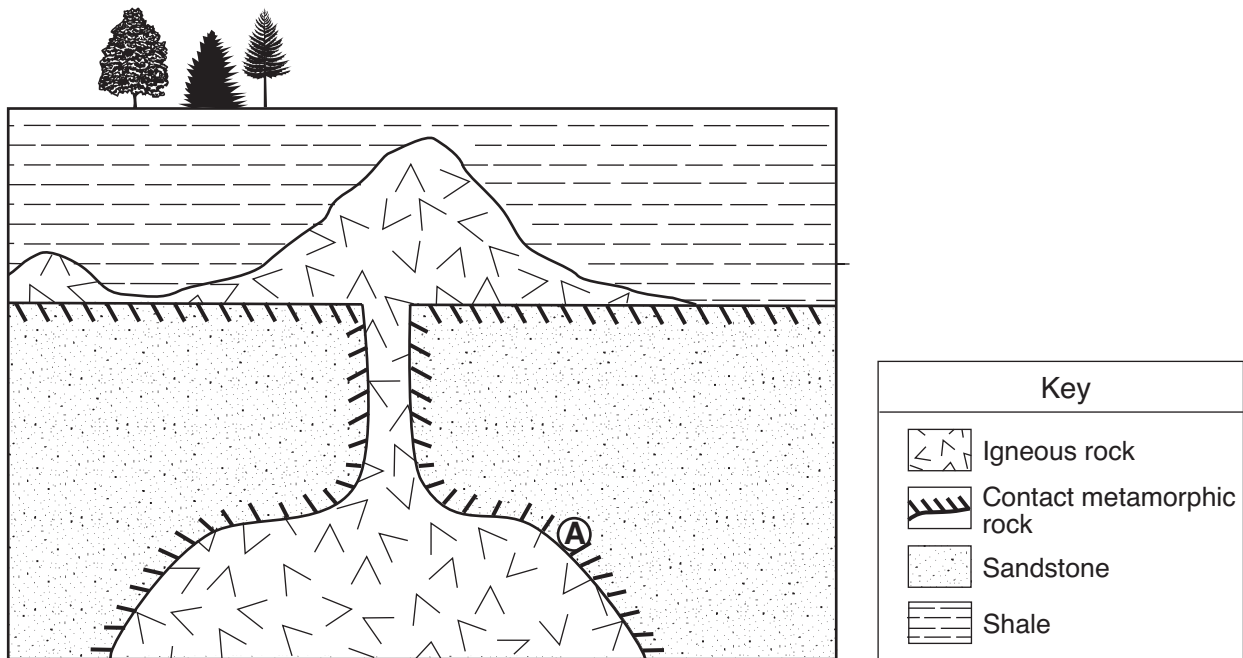
31 In the United States, most of the major damage expected from a future earthquake is predicted to occur near a

- (1) divergent plate boundary, only
- (2) convergent plate boundary, only
- (3) mid-ocean ridge and a divergent plate boundary
- (4) transform plate boundary and a hot spot

32 Which New York State location has the greatest risk of earthquake damage?

- (1) Binghamton
 - (2) Buffalo
 - (3) Plattsburgh
 - (4) Elmira
-

Base your answers to questions 33 and 34 on the geologic cross section below. Location A is within the metamorphic rock.



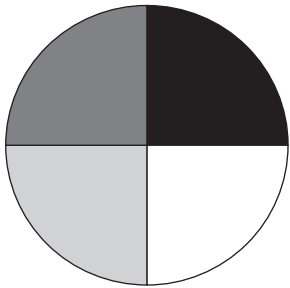
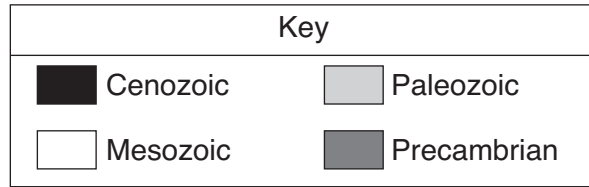
33 The metamorphic rock at location A is most likely

- (1) marble
- (2) quartzite
- (3) phyllite
- (4) slate

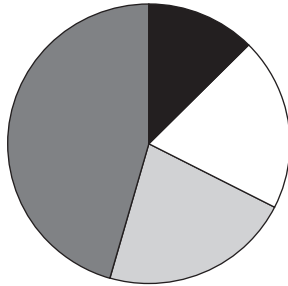
34 Which rock is the youngest?

- (1) shale
 - (2) sandstone
 - (3) igneous rock
 - (4) rock at location A
-

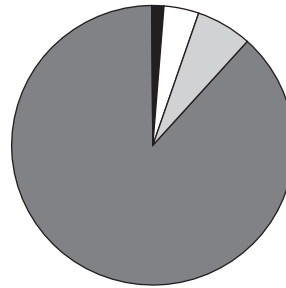
35 Which pie graph best represents the percentage of total time for the four major divisions of geologic time?



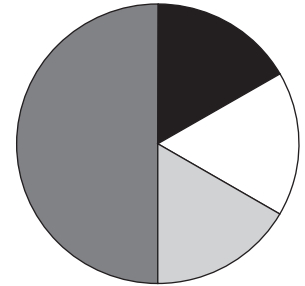
(1)



(2)



(3)



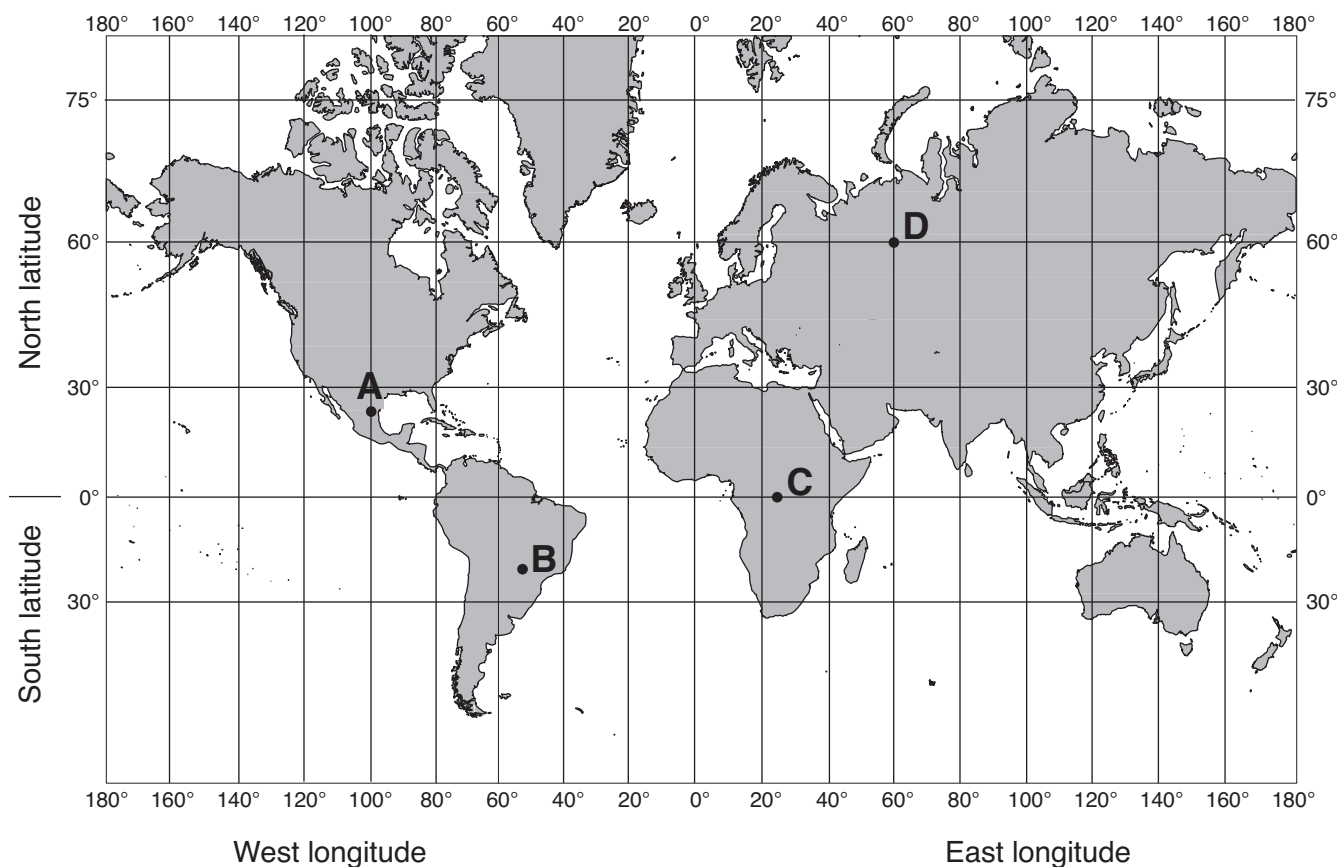
(4)

Part B-1

Answer all questions in this part.

Directions (36–50): For each statement or question, write on your separate answer sheet 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 Earth Science Reference Tables.

Base your answers to questions 36 through 38 on the world map below. Letters A through D represent locations on Earth's surface.



36 At which location could an observer *not* see *Polaris* in the night sky at any time during the year?

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

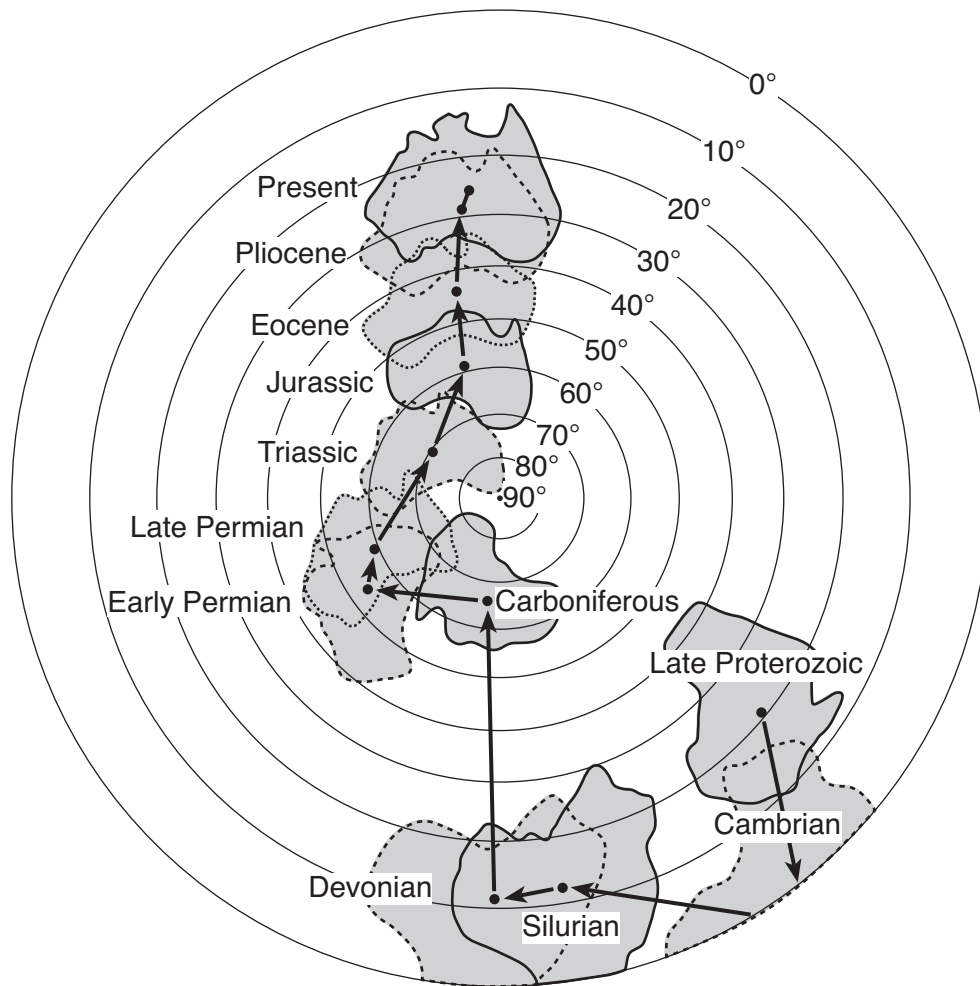
37 Which location receives 12 hours of daylight and 12 hours of darkness on June 21?

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

38 At which location on December 21 is the Sun directly overhead at solar noon?

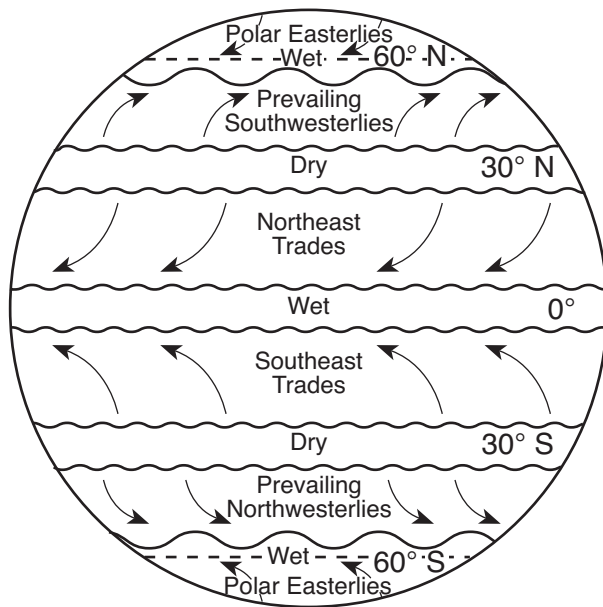
- | | |
|-------|-------|
| (1) A | (3) C |
| (2) B | (4) D |

Base your answers to questions 43 and 44 on the map below, which shows Earth's Southern Hemisphere and the inferred tectonic movement of the continent of Australia over geologic time. The arrows between the dots show the relative movement of the center of the continent of Australia. The parallels of latitude from 0° to 90° south are labeled.



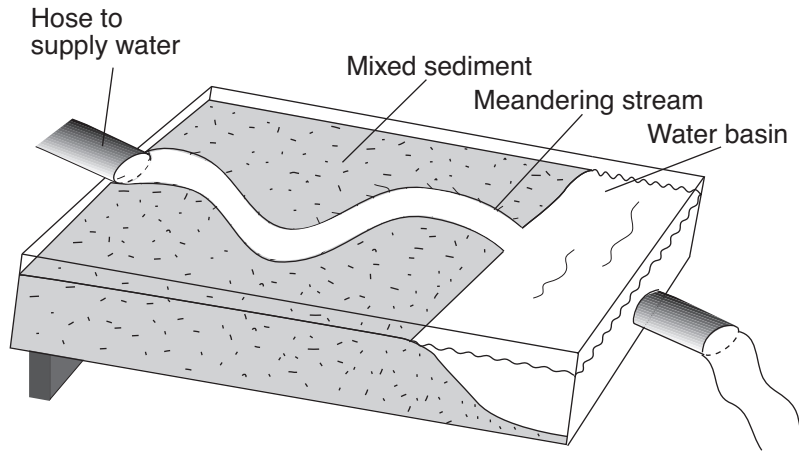
- 43 The geographic position of Australia on Earth's surface has been changing mainly because
- (1) the gravitational force of the Moon has been pulling on Earth's landmasses
 - (2) heat energy has been creating convection currents in Earth's interior
 - (3) Earth's rotation has spun Australia into different locations
 - (4) the tilt of Earth's axis has changed several times
- 44 During which geologic time interval did Australia most likely have a warm, tropical climate because of its location?
- | | |
|-------------------|------------------|
| (1) Cambrian | (3) Late Permian |
| (2) Carboniferous | (4) Eocene |

Base your answers to questions 45 through 47 on the map below, which shows Earth's planetary wind belts.

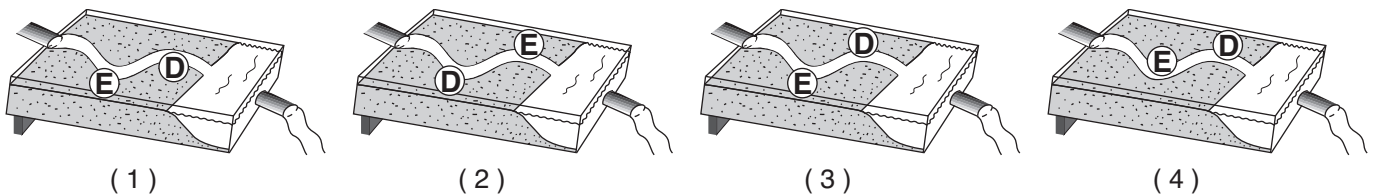


- 45 The curving of these planetary winds is the result of
- (1) Earth's rotation on its axis
 - (2) the unequal heating of Earth's atmosphere
 - (3) the unequal heating of Earth's surface
 - (4) Earth's gravitational pull on the Moon
- 46 Which wind belt has the greatest effect on the climate of New York State?
- (1) prevailing northwesterlies
 - (2) prevailing southwesterlies
 - (3) northeast trades
 - (4) southeast trades
- 47 Which climatic conditions exist where the trade winds converge?
- (1) cool and wet
 - (2) cool and dry
 - (3) warm and wet
 - (4) warm and dry
-

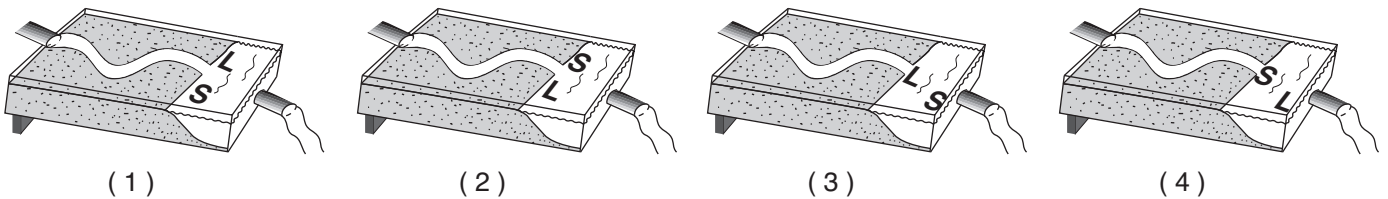
Base your answers to questions 48 through 50 on the diagram below, which shows a model used to investigate the erosional-depositional system of a stream. The model was tilted to create a gentle slope, and a hose supplied water to form the meandering stream shown.



48 Which diagram best represents where erosion, *E*, and deposition, *D*, are most likely occurring along the curves of the meandering stream?



49 Which diagram best represents the arrangement of large, *L*, and small, *S*, sediment deposited as the stream enters the water basin?



50 How can the model be changed to increase the amount of sediment transported by the stream?

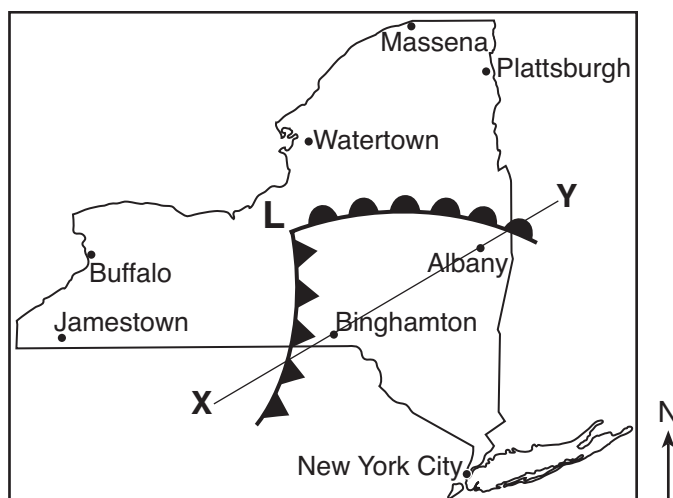
- (1) decrease the temperature of the sediment
- (2) decrease the slope
- (3) increase the size of the sediment
- (4) increase the rate of the water flow

Part B-2

Answer all questions in this part.

Directions (51–64): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 51 through 53 on the weather map below. The weather map shows a low-pressure system in New York State during July. The **L** represents the center of the low-pressure system. Two fronts extend from the center of the low. Line *XY* on the map is a reference line.



- 51 The cross section *in your answer booklet* shows a side view of the area along line *XY* on the map. On lines 1 and 2 in the cross section, place the appropriate two-letter air-mass symbols to identify the most likely type of air mass at *each* of these locations. [1]

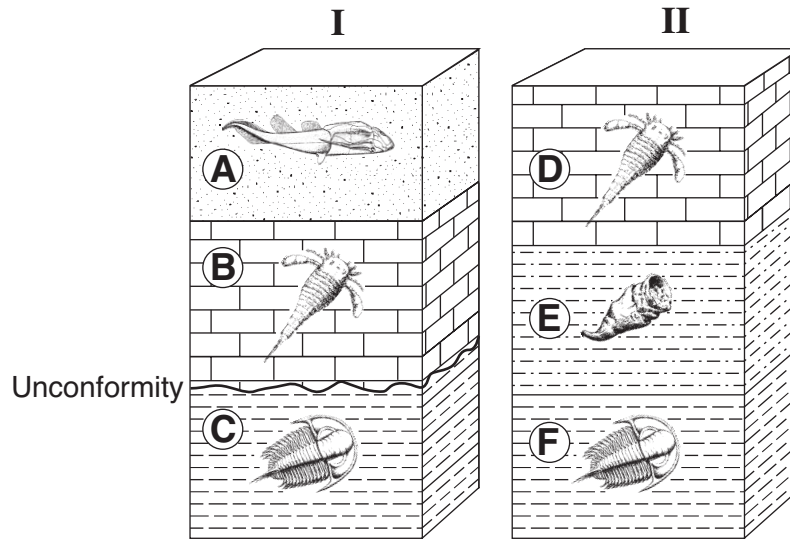
- 52 The forecast for one city located on the map is given below:

“In the next hour, skies will become cloud covered. Heavy rains are expected with possible lightning and thunder. Temperatures will become much cooler.”

State the name of the city for which this forecast was given. [1]

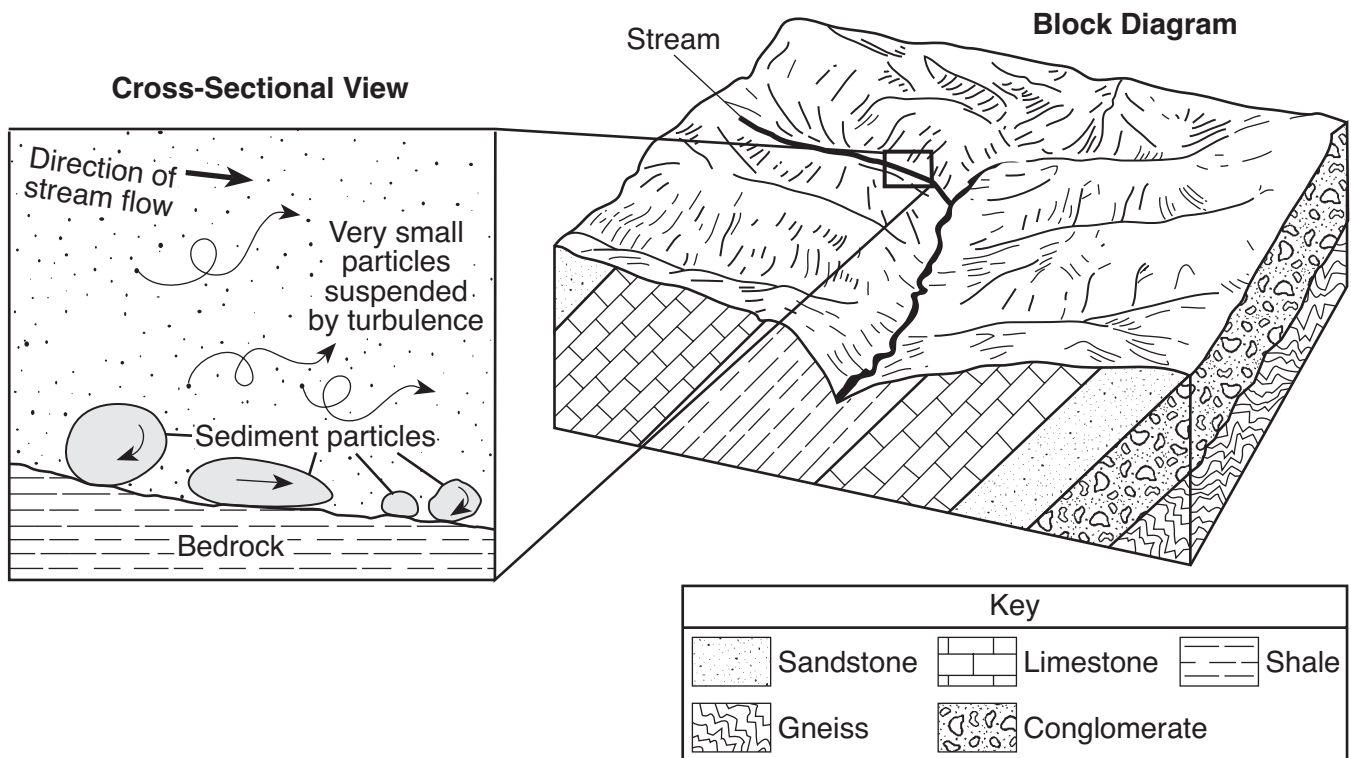
- 53 Identify *one* action that people should take to protect themselves from lightning. [1]

Base your answers to questions 54 through 57 on the diagrams below, which represent two bedrock outcrops, I and II, found several kilometers apart in New York State. Rock layers are lettered A through F. Drawings represent specific index fossils.



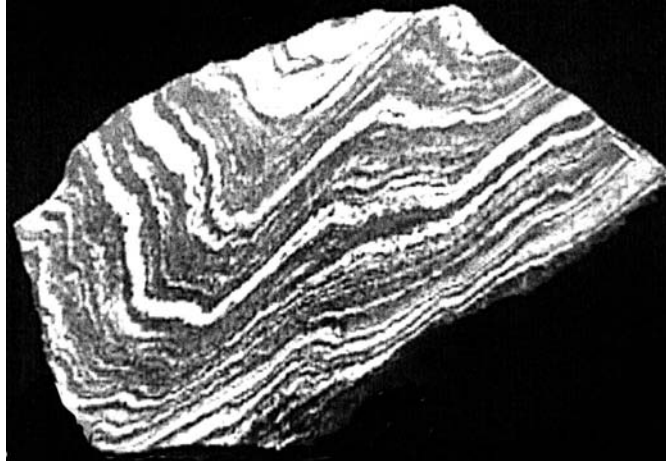
- 54 During which geologic time period was rock layer C deposited? [1]
- 55 Identify *two* processes that produced the unconformity in outcrop I. [1]
- 56 Describe *one* characteristic a fossil must have in order to be considered a good index fossil. [1]
- 57 Explain why carbon-14 can *not* be used to find the geologic age of these index fossils. [1]
-

Base your answers to questions 58 through 61 on the cross section and block diagram below. The cross section shows an enlarged view of the stream shown in the block diagram. The sediments in the cross section are drawn to actual size. Arrows show the movement of particles in the stream. The block diagram represents a region of Earth's surface and the bedrock beneath the region.



- 58 After measuring the actual size, identify the name of the largest particle shown on the stream bottom in the cross section. [1]
- 59 What process is responsible for producing the rounded shape of the particles shown on the stream bottom in the cross section? [1]
- 60 Identify the type of rock shown in the block diagram that appears to be the most easily eroded. [1]
- 61 How does the shape of a valley eroded by a glacier differ from the shape of the valley shown in the block diagram? [1]
-

Base your answers to questions 62 through 64 on the photograph of a sample of gneiss below.



- 62 What observable characteristic could be used to identify this rock sample as gneiss? [1]
- 63 Identify *two* minerals found in gneiss that contain iron and magnesium. [1]
- 64 A dark-red mineral with a glassy luster was also observed in this gneiss sample. Identify the mineral and state *one* possible use for this mineral. [1]
-

Part C

Answer all questions in this part.

Directions (65–82): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 65 through 69 on the data table below, which shows the percentage of the lighted side of the Moon visible from Earth for the first fourteen days of July 2003.

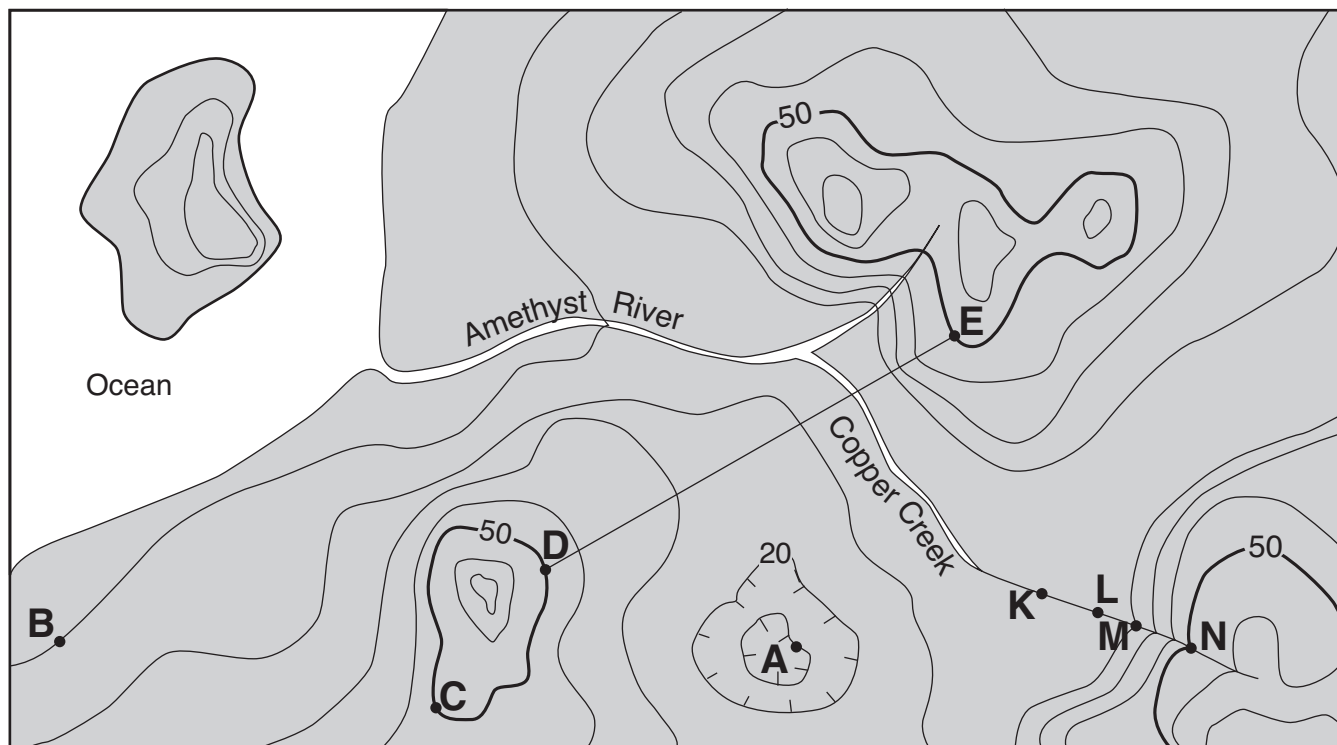
Date	Percentage of Lighted Side of the Moon Visible From Earth (%)
July 1	1
July 2	5
July 3	10
July 4	17
July 5	26
July 6	37
July 7	48
July 8	59
July 9	70
July 10	80
July 11	89
July 12	95
July 13	98
July 14	100

- 65 On what July date listed in the table did the Moon appear as shown below? [1]

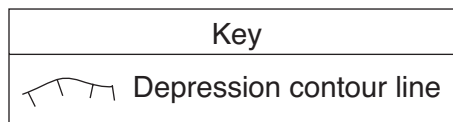


- 66 What motion of the Moon causes the percentage of the lighted side of the Moon visible from Earth to change from July 1 to July 14? [1]
- 67 A full Moon phase was observed on July 14. On what day in August was the next full Moon phase observed? [1]
- 68 The diagram *in your answer booklet* shows the orbit of the Moon around Earth. Place an **X** on the orbit to show where the Moon was in its orbit on July 14, 2003. [1]
- 69 Why are the phases of the Moon considered to be cyclic? [1]
-

Base your answers to questions 70 through 73 on the topographic map shown below. Letters A, B, C, D, and E represent locations on Earth's surface. Letters K, L, M, and N are locations along Copper Creek. Elevations are measured in meters.



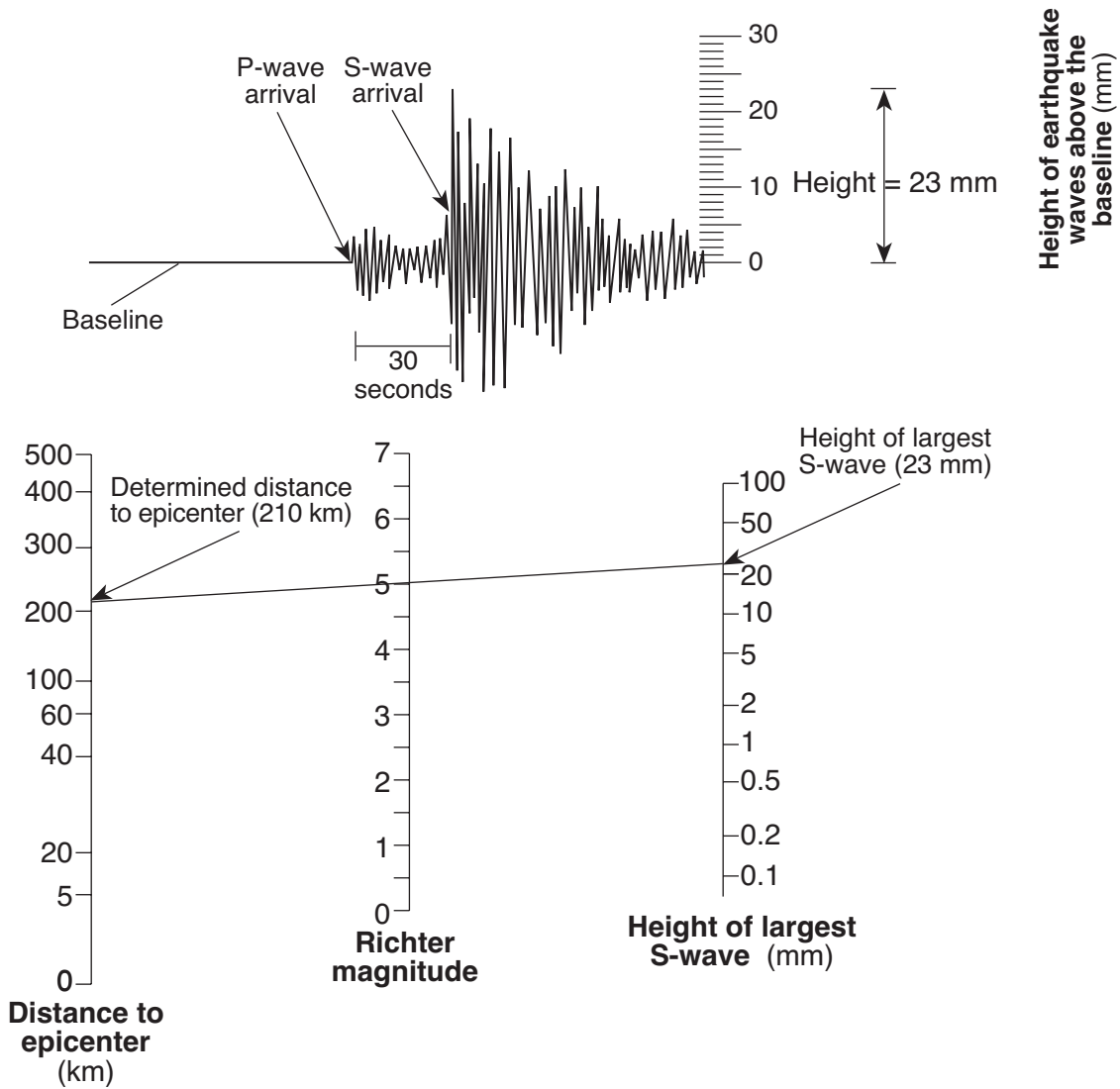
Contour interval = 10 meters



- 70 What is the elevation of location A? [1]
- 71 Calculate the gradient between points B and C and label your answer with the correct units. [2]
- 72 On the grid in your answer booklet, construct a topographic profile along line DE by plotting an **X** for the elevation of each contour line that crosses line DE. Connect the **X**s with a smooth, curved line to complete the profile. [2]
- 73 Explain how the map indicates that Copper Creek flows faster between points N and M than between points L and K. [1]

Base your answers to questions 74 through 76 on the example of a seismogram and set of instructions for determining the Richter magnitude of an earthquake below. The example shows the Richter magnitude of an earthquake 210 kilometers from a seismic station.

Example of a Seismogram of an Earthquake

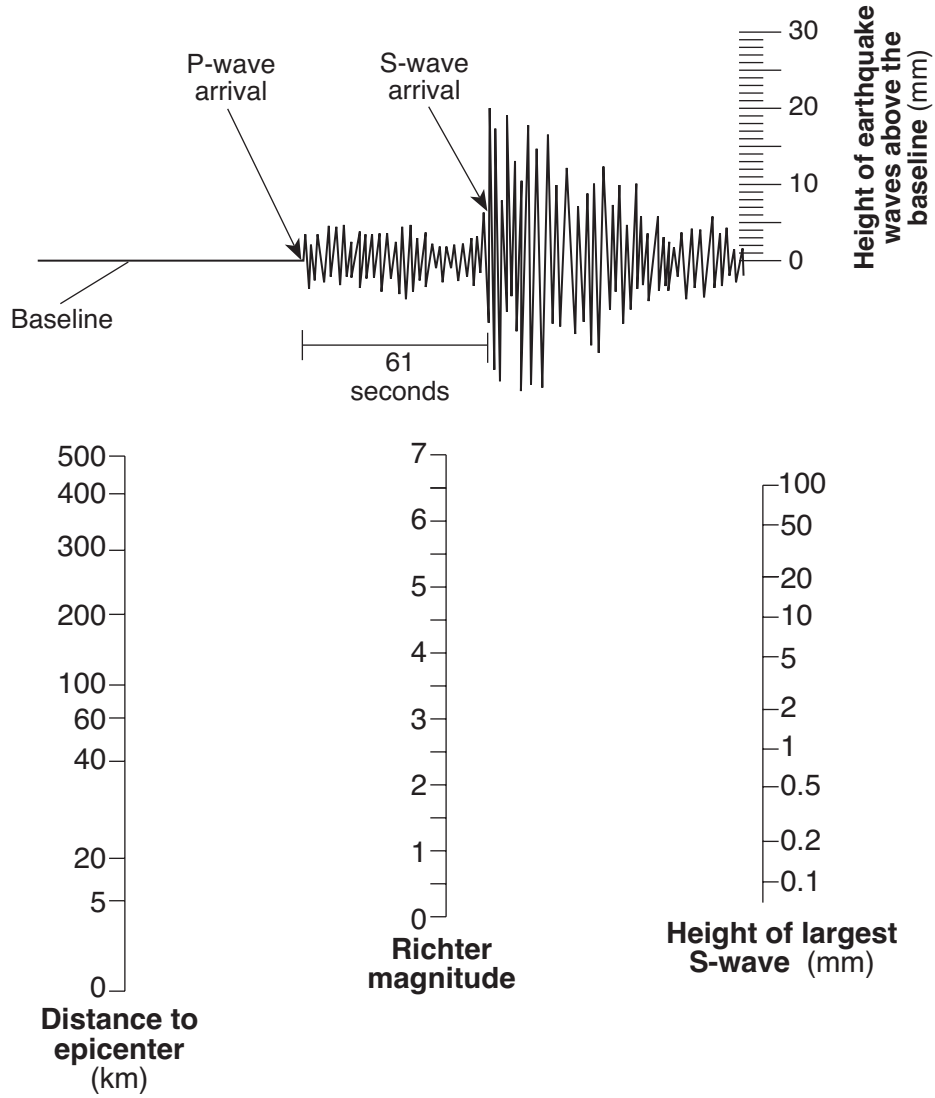


Instructions for determining Richter magnitude:

- Determine the distance to the epicenter of the earthquake. (The distance in the example is 210 kilometers.)
- Measure the maximum wave height of the S-wave recorded on the seismogram. (The height in the example is 23 millimeters.)
- Place a straightedge between the distance to the epicenter (210 kilometers) and the height of the largest S-wave (23 millimeters) on the appropriate scales. Draw a line connecting these two points. The magnitude of the earthquake is determined by where the line intersects the Richter magnitude scale. (The magnitude of this example is 5.0.)

- 74 Using the set of instructions on page 22 and the seismogram and scales below, determine the Richter magnitude of an earthquake that was located 500 kilometers from this seismic station. Record your answer *in your answer booklet*. [1]

Seismogram of an Earthquake



- 75 Identify the information shown on the seismogram that was used to determine that the distance to the epicenter was 500 kilometers. [1]

- 76 How long did it take the first S-wave to travel 500 kilometers to reach this seismic station? [1]
-


Base your answers to questions 77 through 81 on the passage below and on the map in your answer booklet. The passage describes the Gakkel Ridge found at the bottom of the Arctic Ocean. The map shows the location of the Gakkel Ridge.

The Gakkel Ridge


In the summer of 2001, scientists aboard the U.S. Coast Guard icebreaker *Healy* visited one of the least explored places on Earth. The scientists studied the 1800-kilometer-long Gakkel Ridge at the bottom of the Arctic Ocean near the North Pole. The Gakkel Ridge is a section of the Arctic Mid-Ocean Ridge and extends from the northern end of Greenland across the Arctic Ocean floor toward Russia. At a depth of about 5 kilometers below the ocean surface, the Gakkel Ridge is one of the deepest mid-ocean ridges in the world. The ridge is believed to extend down to Earth's mantle, and the new seafloor being formed at the ridge is most likely composed of huge slabs of mantle rock. Bedrock samples taken from the seafloor at the ridge were determined to be the igneous rock peridotite.


The Gakkel Ridge is also the slowest moving mid-ocean ridge. Some ridge systems, like the East Pacific Ridge, are rifting at a rate of about 20 centimeters per year. The Gakkel Ridge is rifting at an average rate of less than 1 centimeter per year. This slow rate of movement means that there is less volcanic activity along the Gakkel Ridge than along other ridge systems. However, heat from the underground magma slowly seeps up through cracks in the rocks of the ridge at structures scientists call hydrothermal (hot water) vents. During the 2001 cruise, a major hydrothermal vent was discovered at 87° N latitude 45° E longitude.

77 On the map *in your answer booklet*, place an **X** on the location of the major hydrothermal vent described in the passage. [1]

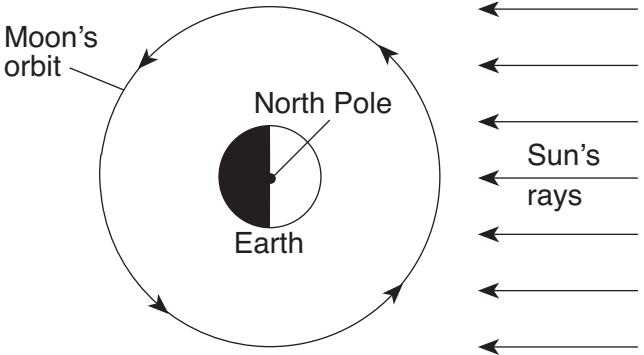
 78 Describe the relative motion of the two tectonic plates on either side of the Gakkel Ridge. [1]

 79 The Gakkel Ridge is a boundary between which two tectonic plates? [1]

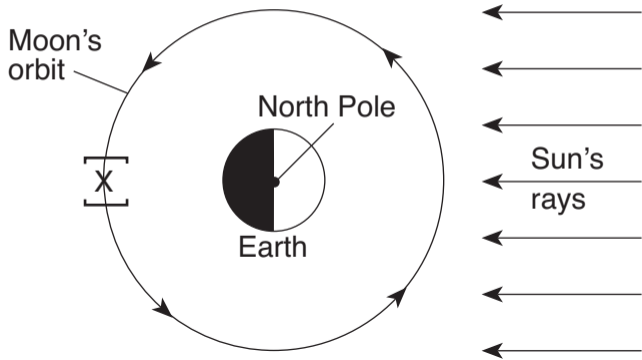
 80 Identify *one* feature, other than hydrothermal vents, often found at mid-ocean ridges like the Gakkel Ridge that indicates heat from Earth's interior is escaping. [1]

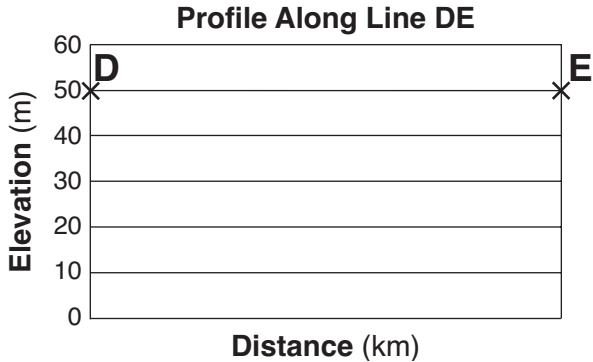
 81 State the *two* minerals that were most likely found in the igneous bedrock samples collected at the Gakkel Ridge. [1]

82 The diagram *in your answer booklet* shows a view of the ground from directly above a flagpole in New York State at solar noon on a particular day of the year. The flagpole's shadow at solar noon is shown. Draw the position and relative length of the shadow that would be cast by this flagpole three hours later. [2]



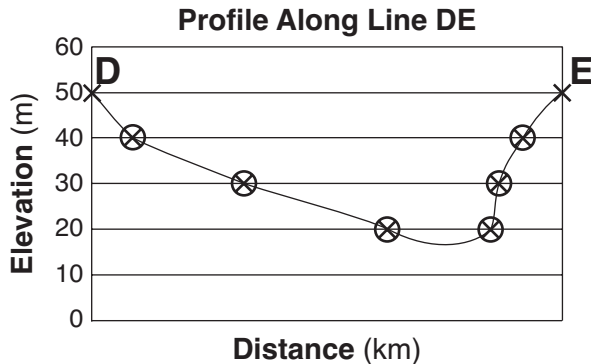
68 [1] Allow 1 credit if the center of the student's **X** is placed within the brackets shown.

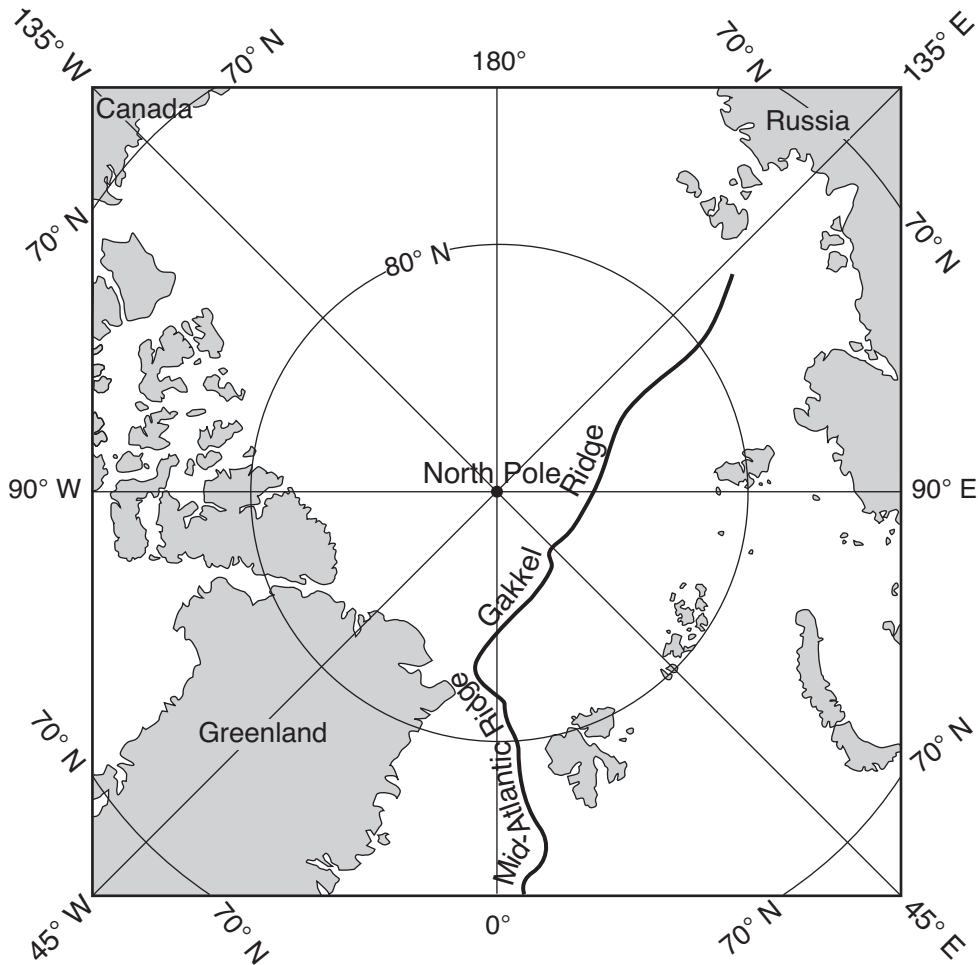




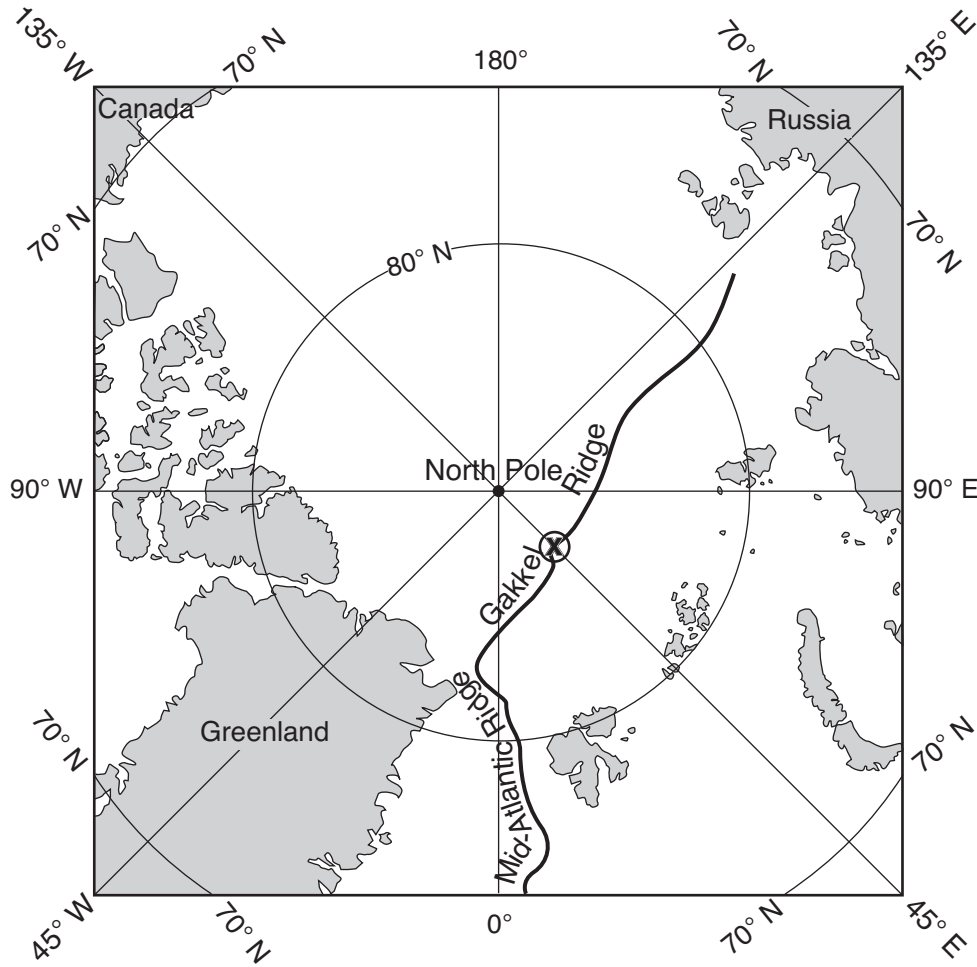
72 [2] Allow a maximum of 2 credits, allocated as follows:

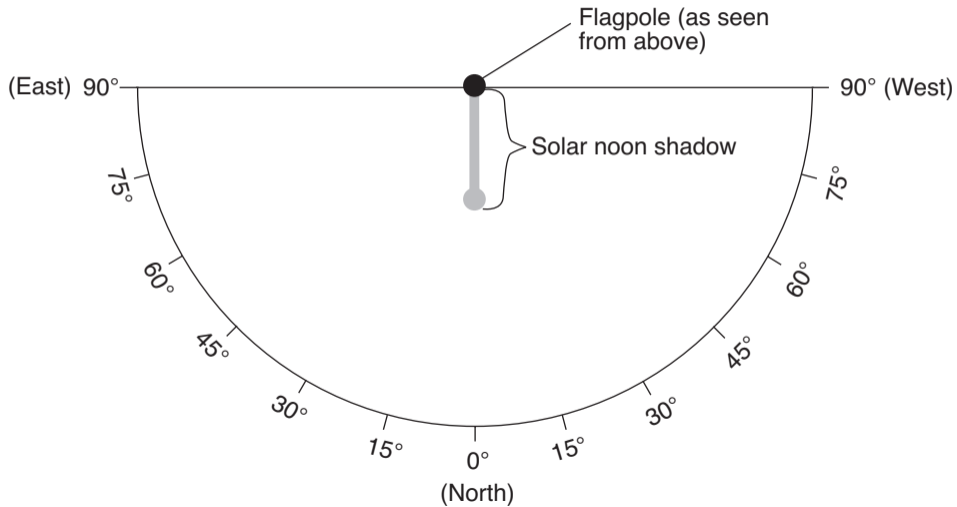
- Allow 2 credits if the centers of five or six **X**s are located within the circles shown on the profile and are correctly connected with a line that passes within the circles. The line must have the lowest elevation between 10 and 20 meters.
- Allow 1 credit if the centers of five or six **X**s are located within the circles shown on the profile but the line is *not* correctly drawn or is missing.





77 [1] Allow 1 credit if the center of the **X** falls within the circle shown.





82 [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit if the shadow three hours later is drawn within the dashed lines shown below.
- Allow 1 credit if the length of the shadow after three hours is longer than the solar noon shadow. Allow this credit even if the direction of the shadow is incorrectly drawn.

