

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

# PHYSICAL SETTING EARTH SCIENCE



Wednesday, August 18, 2010 — 12:30 to 3:30 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.

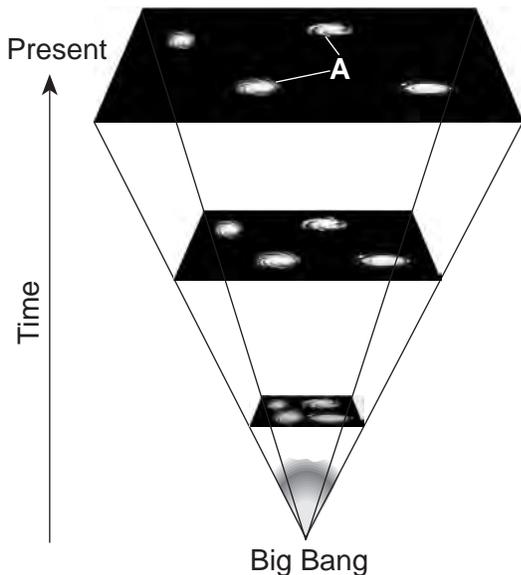
**DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.**

**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.*

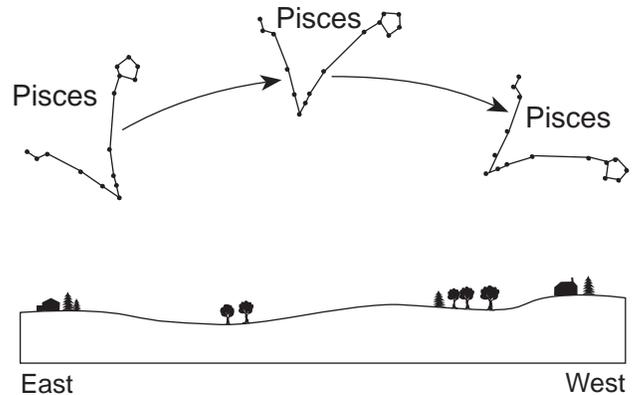
- Evidence of mass extinctions of life-forms is preserved in the fossil record. It is inferred that some of these extinctions occurred because of
  - earthquakes
  - asteroid impacts
  - solar eclipses
  - tsunamis
- By which process do stars convert mass into great amounts of energy?
  - nuclear fusion
  - heat transfer
  - gravitational pull
  - radioactive decay
- The diagram below represents the development of our universe from the time of the Big Bang until the present. Letter A indicates two celestial objects.



The present-day celestial objects labeled A are best identified as

- asteroid belts
- terrestrial planets
- spiral galaxies
- eccentric comets

- The constellation Pisces changes position during a night, as shown in the diagram below.



Which motion is mainly responsible for this change in position?

- revolution of Earth around the Sun
  - rotation of Earth on its axis
  - revolution of Pisces around the Sun
  - rotation of Pisces on its axis
- The diagram below represents the bright-line spectrum for an element.



The spectrum of the same element observed in the light from a distant star is shown below.



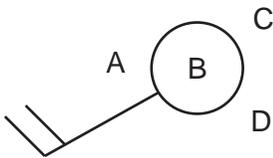
The shift in the spectral lines indicates that the star is moving

- toward Earth
- away from Earth
- in an elliptical orbit around the Sun
- in a circular orbit around the Sun

- 6 Compared to the other planets in our solar system, Jupiter, Saturn, and Neptune have
- (1) shorter periods of rotation
  - (2) shorter periods of revolution
  - (3) greater eccentricities
  - (4) greater densities

- 7 Air pressure is usually highest when the air is
- (1) cool and humid
  - (2) cool and dry
  - (3) warm and humid
  - (4) warm and dry

- 8 Weather data is normally recorded at positions A, B, C, and D on the weather station model shown below.



At which position should the measurements from a rain gauge be recorded?

- (1) A
  - (2) B
  - (3) C
  - (4) D
- 9 Heat energy from the lower latitudes is transferred to colder Earth regions by planetary wind circulation mainly through the process of
- (1) conduction
  - (2) radiation
  - (3) convection
  - (4) reflection
- 10 The Coriolis effect is a result of Earth's
- (1) tilted axis
  - (2) orbital shape
  - (3) revolution
  - (4) rotation
- 11 For weeks after a series of major volcanic eruptions, Earth's surface air temperatures are often
- (1) warmer because ash and dust decrease atmospheric transparency
  - (2) warmer because ash and dust increase atmospheric transparency
  - (3) cooler because ash and dust decrease atmospheric transparency
  - (4) cooler because ash and dust increase atmospheric transparency

- 12 The table below shows how the radioactive decay of potassium-40 can be used to determine the age of a rock.

Ratio of Radioactive Potassium-40 to Nonradioactive Decay Products	Age of Rock (years)
1:0	0
1:1	$1.3 \times 10^9$
1:3	$2.6 \times 10^9$
1:7	$3.9 \times 10^9$
1:15	$5.2 \times 10^9$
1:31	$6.5 \times 10^9$

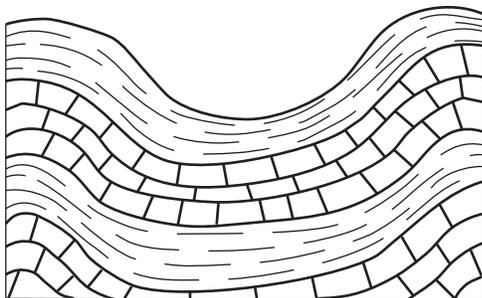
How old is a sample of granite that contains 8 grams of radioactive potassium-40 and 56 grams of its nonradioactive decay products?

- (1)  $1.3 \times 10^9$  years old
  - (2)  $2.6 \times 10^9$  years old
  - (3)  $3.9 \times 10^9$  years old
  - (4)  $5.2 \times 10^9$  years old
- 13 Which gas became part of Earth's atmosphere mainly as a result of the evolution of life-forms?
- (1) oxygen
  - (2) nitrogen
  - (3) helium
  - (4) hydrogen
- 14 Devonian-age fossils found in New York State bedrock, such as *Manticoceras* and *Mucrospirifer*, provide evidence that parts of New York State were once
- (1) under a shallow sea containing tropical waters
  - (2) higher in elevation and eroded extensively by glaciers
  - (3) covered by extensive lava flows
  - (4) impacted by comets and asteroids
- 15 Which two types of organisms both survived the mass extinction that occurred at the end of the Permian Period?
- (1) trilobites and nautiloids
  - (2) corals and vascular plants
  - (3) placoderm fish and graptolites
  - (4) gastropods and eurypterids

16 Antarctica's location and climate changed over the last 200 million years because Antarctica moved

- (1) southward, resulting in a warmer climate
- (2) southward, resulting in a colder climate
- (3) northward, resulting in a warmer climate
- (4) northward, resulting in a colder climate

17 The cross section below shows a portion of Earth's crust.



Which observation provides the most direct evidence that crustal plate collision has occurred near this region?

- (1) alternating layers of shale and limestone bedrock
- (2) absence of an igneous intrusive rock
- (3) different thicknesses of the sedimentary layers
- (4) folding of the sedimentary layers

18 In New York State, both the Delaware River and the Susquehanna River flow over landscapes classified as

- (1) mountain regions      (3) lowlands
- (2) coastal plains        (4) plateaus

19 A river's velocity slows from 100 to 50 centimeters per second at a point in its channel. Which statement best describes the transport and deposition of particles at this point?

- (1) Clay, silt, sand, pebbles, and smaller cobbles stay in transport; some cobbles are deposited.
- (2) Clay, silt, sand, and smaller pebbles stay in transport; some pebbles are deposited.
- (3) Clay, silt, and smaller sand stay in transport; some sand is deposited.
- (4) Clay and smaller silt stay in transport; some silt is deposited.

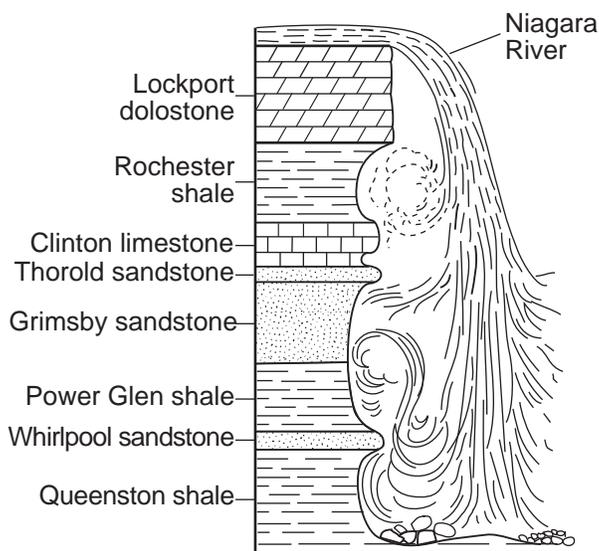
20 The photograph below shows farm buildings partially buried in silt.



Which erosional agent most likely piled the silt against these buildings?

- (1) glacial ice                      (3) wind
- (2) ocean waves                  (4) mass movement

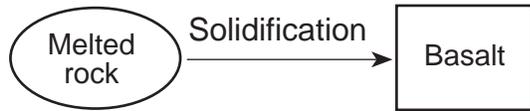
21 The generalized cross section below shows the sedimentary rock layers at Niagara Falls in western New York State.



Which rock layer appears to be most resistant to weathering and erosion?

- (1) Lockport dolostone      (3) Grimsby sandstone
- (2) Rochester shale        (4) Queenston shale

- 22 The flowchart below illustrates the change from melted rock to basalt.



The solidification of the melted rock occurred

- (1) slowly, resulting in fine-grained minerals
- (2) slowly, resulting in coarse-grained minerals
- (3) rapidly, resulting in coarse-grained minerals
- (4) rapidly, resulting in fine-grained minerals

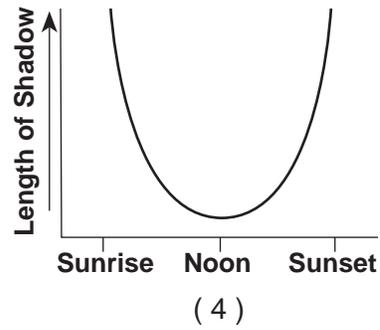
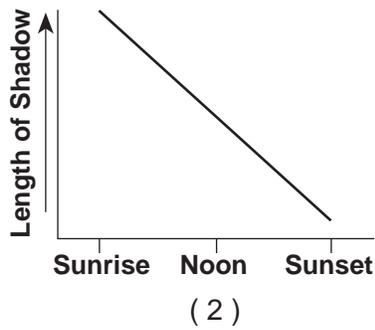
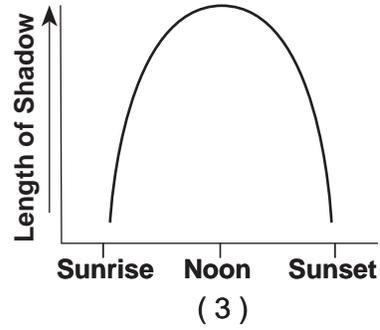
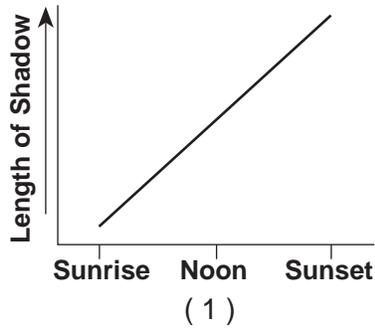
- 23 Soil that contains large quantities of calcium was most likely formed by the weathering of

- (1) rock salt
- (2) quartzite
- (3) coal
- (4) limestone

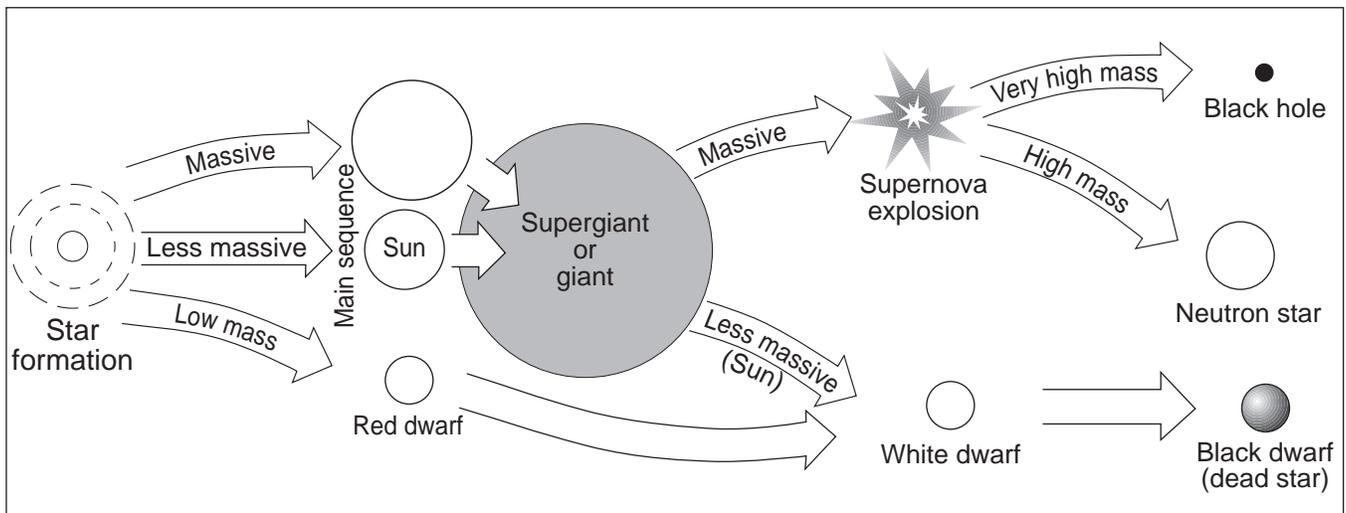
- 24 Which mineral is commonly used as a food additive?

- (1) calcite
- (2) talc
- (3) halite
- (4) fluorite

25 Which graph best shows the length of a shadow cast from sunrise to sunset by a flagpole in New York State?



26 The diagram below represents possible stages in the life cycle of stars.

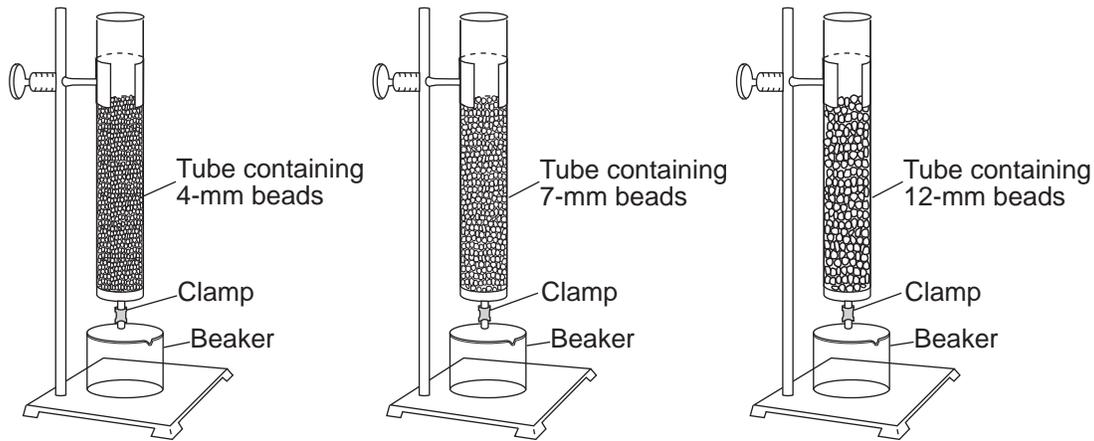


(Not drawn to scale)

Which star has the greatest probability of producing a supernova explosion?

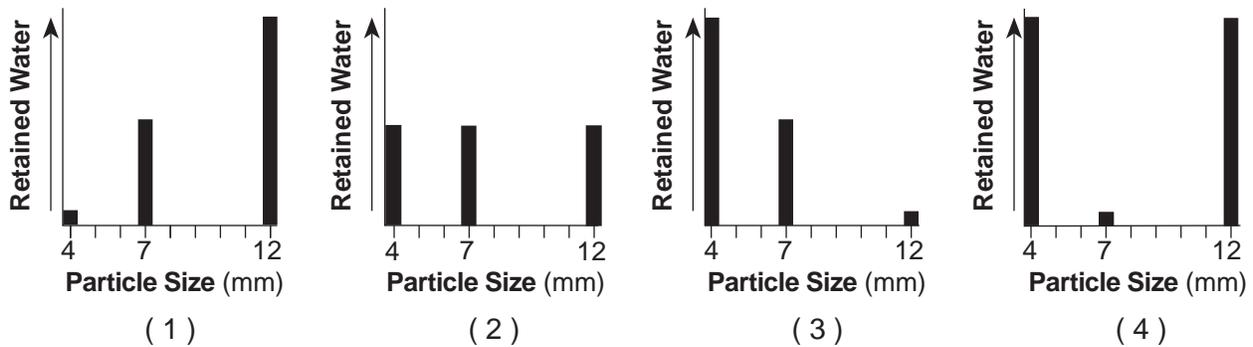
- (1) *Barnard's Star*
- (2) *Betelgeuse*
- (3) *Procyon B*
- (4) *Sun*

27 The diagram below shows three identical plastic tubes filled to the same level with spherical beads of different diameters. Each tube was filled with water to the top of the beads. The clamps were then opened to allow water to drain into the beakers.

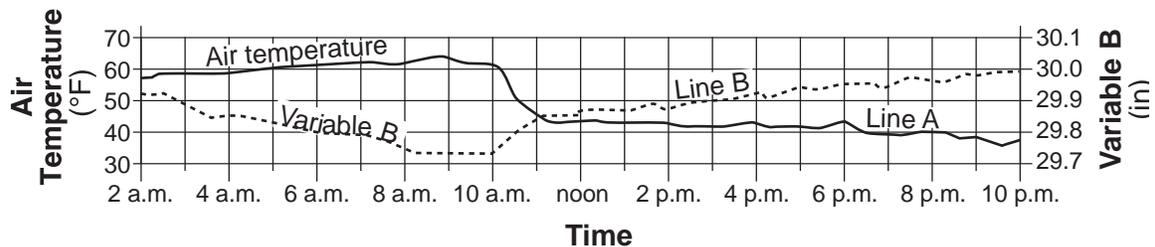


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Which graph best represents the relative amount of water retained by the beads in each tube?



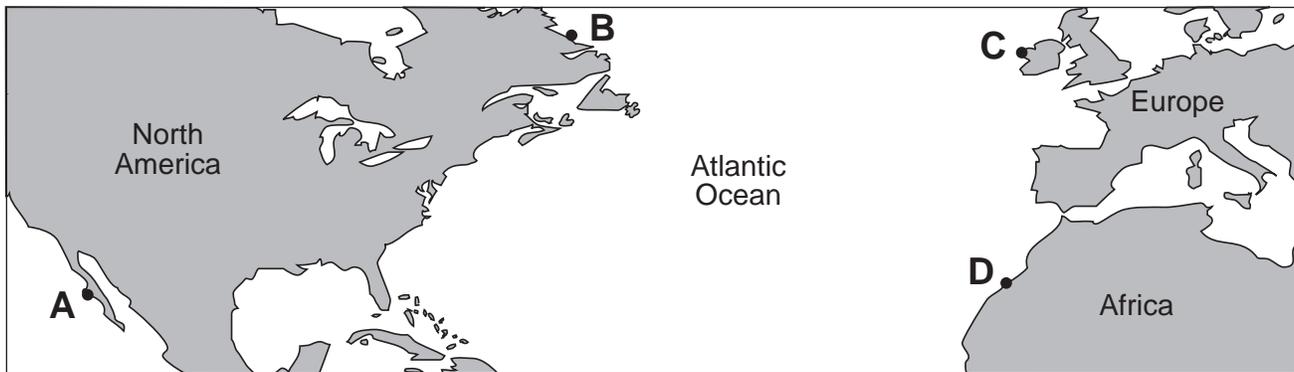
28 Data from two weather instruments have been recorded on the graph below. Line A on the graph represents air-temperature data. Line B was plotted using the scale for variable B.



Line B on the graph represents data from which weather instrument?

- (1) thermometer
- (2) barometer
- (3) psychrometer
- (4) anemometer

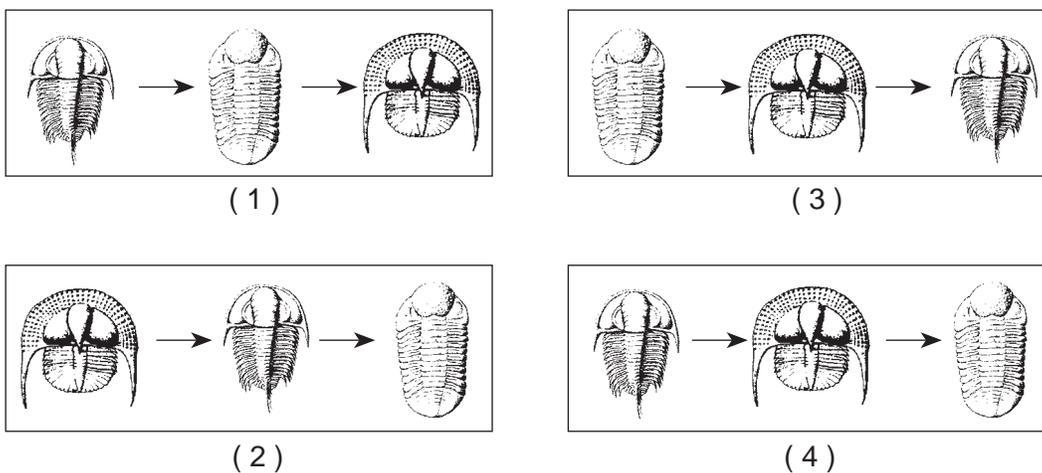
29 The map below shows four coastal locations labeled A, B, C, and D.



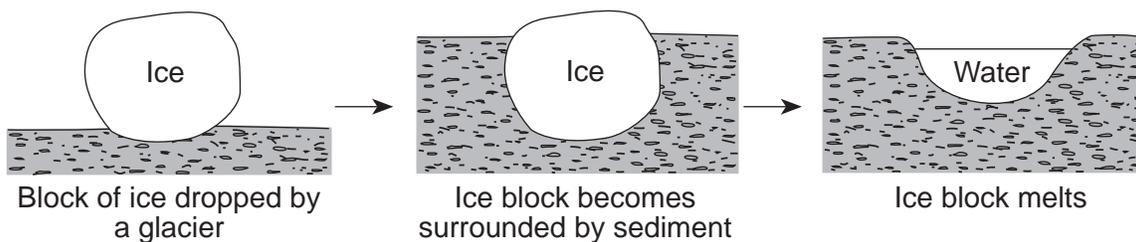
The climate of which location is warmed by a nearby major ocean current?

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

30 Which fossil sequence is in order from oldest to youngest?



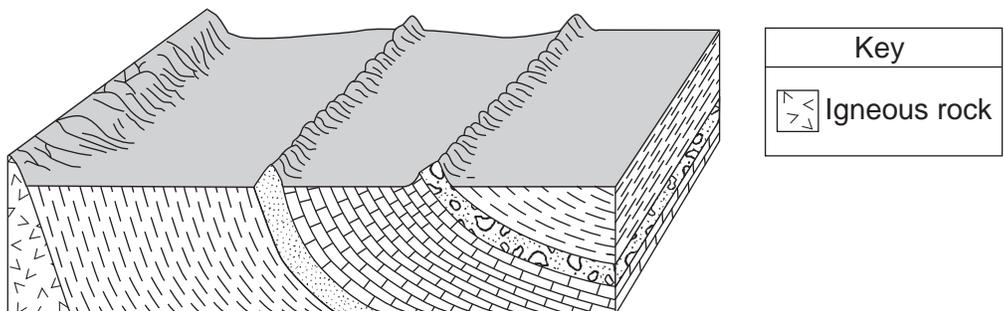
31 The diagram below shows a glacial landscape feature forming over time from a melting block of ice.



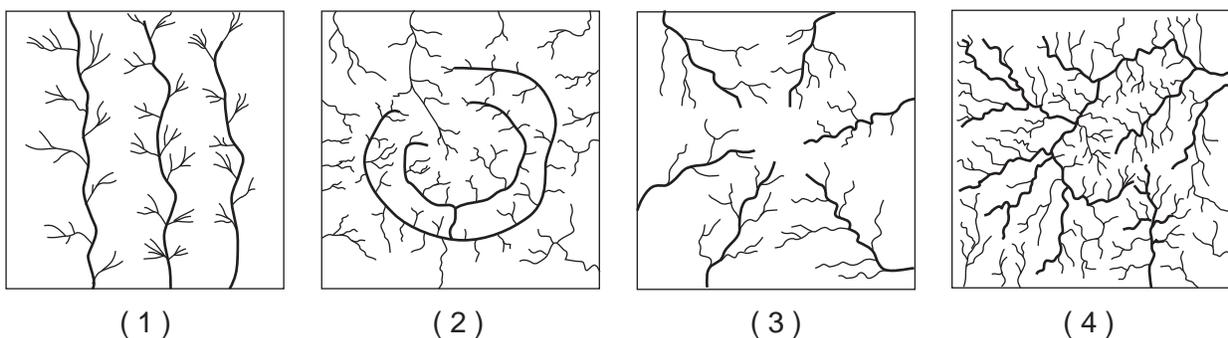
This glacial landscape feature is best identified as

- (1) a kettle lake
- (2) an outwash plain
- (3) a finger lake
- (4) a moraine

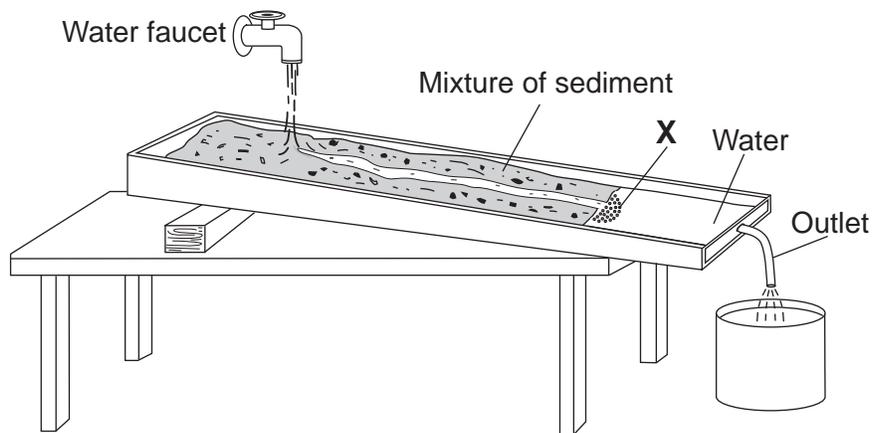
32 The block diagram below shows a landscape region.



Which stream drainage pattern would most likely develop at the surface of this region?



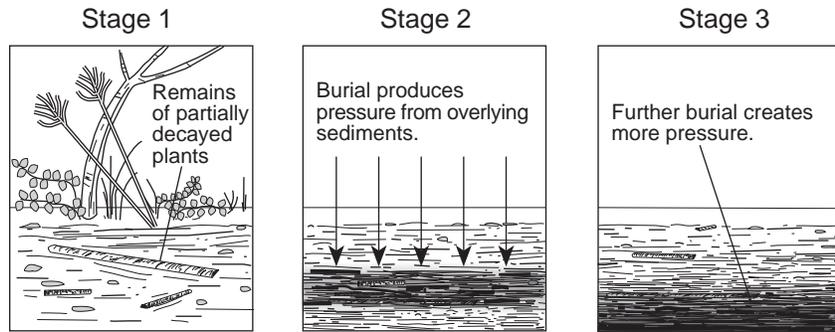
33 The diagram below shows a laboratory stream table. A mixture of sediment was placed on the stream table. A short time after the faucet was turned on, a deposit of sediment began forming at location X at the lower end of the stream table.



What is the name of the stream feature forming at location X?

- |                     |                |
|---------------------|----------------|
| (1) V-shaped valley | (3) delta      |
| (2) meander         | (4) floodplain |

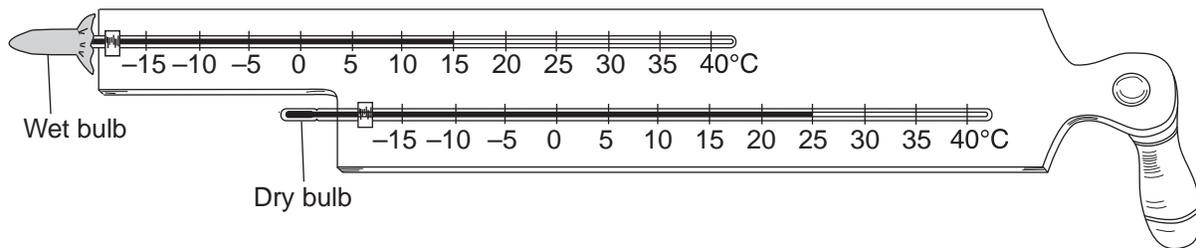
34 The diagram below shows three stages in the formation of a specific rock.



Which rock is formed as a result of these three stages?

- (1) limestone
- (2) gneiss
- (3) schist
- (4) coal

35 The diagram below shows the temperature readings on a weather instrument.



Based on these readings, the relative humidity of the air is closest to

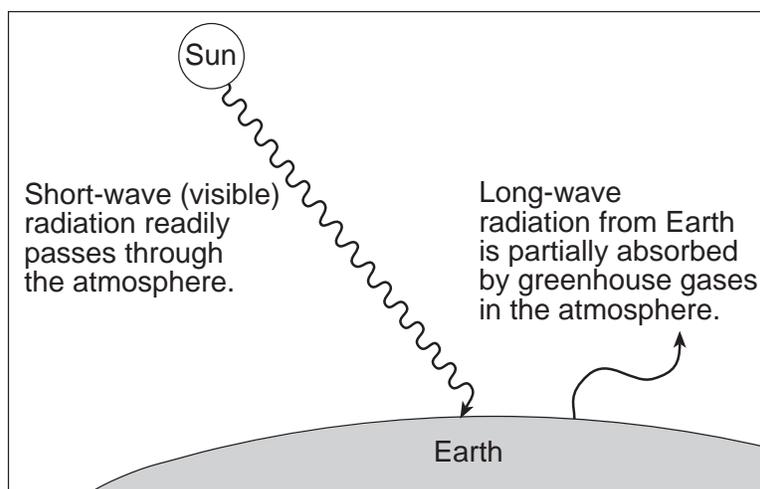
- (1) 8%
- (2) 11%
- (3) 32%
- (4) 60%

## 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 represents the greenhouse effect in which heat energy is trapped in Earth's atmosphere.

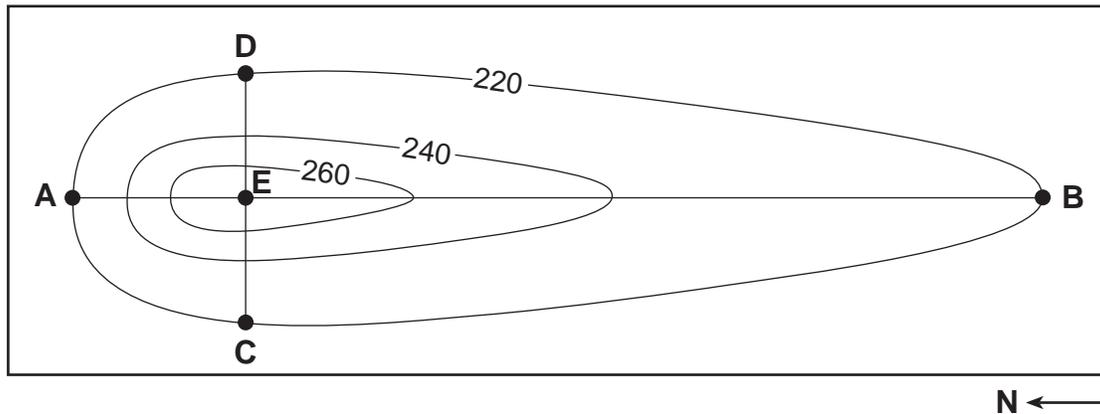


(Not drawn to scale)

- 36 Which type of radiation from Earth is the long-wave radiation absorbed by greenhouse gases?
- |                   |                 |
|-------------------|-----------------|
| (1) ultraviolet   | (3) infrared    |
| (2) visible light | (4) radio waves |
- 37 The Earth surface that best absorbs short-wave solar radiation has which characteristics?
- |                      |                      |
|----------------------|----------------------|
| (1) black and rough  | (3) white and rough  |
| (2) black and smooth | (4) white and smooth |
-

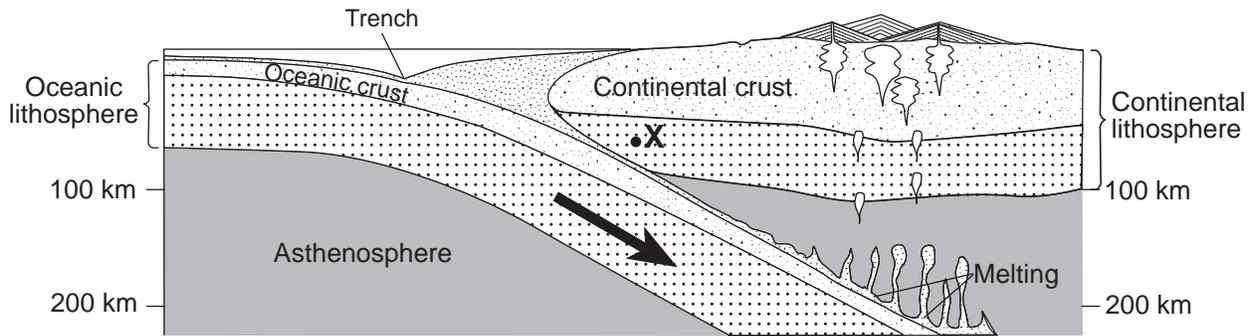
Base your answers to questions 38 through 41 on the contour map below, which shows a hill formed by glacial deposition near Rochester, New York. Letters A through E are reference points. Elevations are in feet.

**Contour Map**



- 38 This glacial deposit is best identified as
- |                       |                      |
|-----------------------|----------------------|
| (1) a U-shaped valley | (3) a drumlin        |
| (2) a sand dune       | (4) an outwash plain |
- 39 Which description best compares the gradients of this hill?
- |   |   |
|---|---|
| (1) <i>AE</i> and <i>EB</i> have the same gradient.   | (3) <i>CE</i> has a steeper gradient than <i>ED</i> . |
| (2) <i>AE</i> has a steeper gradient than <i>EB</i> . | (4) <i>CE</i> and <i>AE</i> have the same gradient.   |
- 40 Which set of characteristics most likely describes the sediment in this glacial deposit?
- |                            |                              |
|----------------------------|------------------------------|
| (1) sorted and layered     | (3) unsorted and not layered |
| (2) sorted and not layered | (4) unsorted and layered     |
- 41 The hill shown on this map is found in which New York State landscape region?
- |                          |                            |
|--------------------------|----------------------------|
| (1) Adirondack Mountains | (3) Atlantic Coastal Plain |
| (2) Catskills            | (4) Erie-Ontario Lowlands  |

Base your answers to questions 42 through 45 on the cross section below, which shows the boundary between two lithospheric plates. Point X is a location in the continental lithosphere. The depth below Earth's surface is labeled in kilometers.

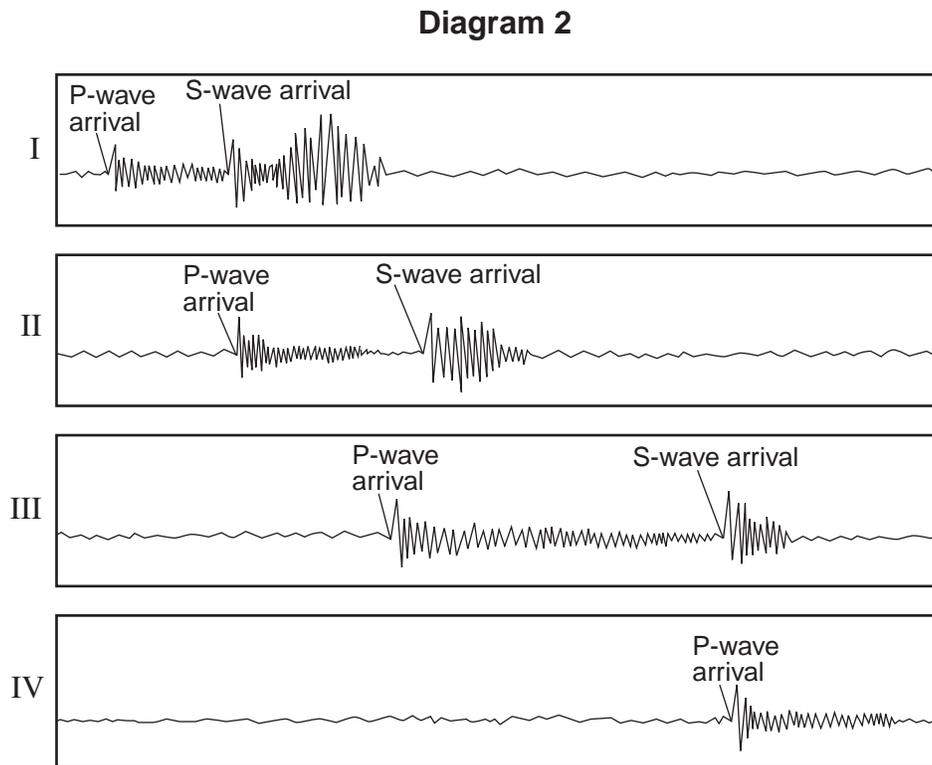
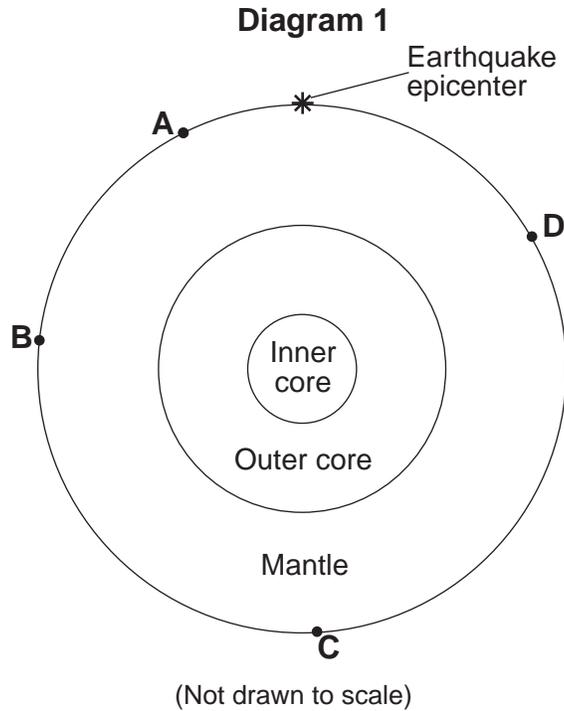


(Not drawn to scale)

- 42 Between which two lithospheric plates could this boundary be located?
- (1) South American Plate and African Plate
  - (2) Scotia Plate and Antarctic Plate
  - (3) Nazca Plate and South American Plate
  - (4) African Plate and Arabian Plate
- 43 Compared to the continental crust, the oceanic crust is
- (1) less dense and thinner
  - (2) less dense and thicker
  - (3) more dense and thinner
  - (4) more dense and thicker
- 44 The temperature of the asthenosphere at the depth where melting first occurs is inferred to be approximately
- (1) 100°C
  - (2) 1300°C
  - (3) 4200°C
  - (4) 5000°C
- 45 Point X is located in which Earth layer?
- (1) rigid mantle
  - (2) stiffer mantle
  - (3) asthenosphere
  - (4) outer core

Base your answers to questions 46 and 47 on the diagrams below. Diagram 1 represents a cross section of Earth and its interior layers. The asterisk (\*) shows the location of an earthquake epicenter. Letters *A* through *D* are seismic stations on Earth's surface.

Diagram 2 shows four seismograms labeled I, II, III, and IV, which were recorded at seismic stations *A*, *B*, *C*, and *D* during the same time interval.



46 Which list correctly matches the seismograms with the seismic stations where they were recorded?

(1) seismogram I – station *A*  
seismogram II – station *B*  
seismogram III – station *C*  
seismogram IV – station *D*

(2) seismogram I – station *B*  
seismogram II – station *D*  
seismogram III – station *A*  
seismogram IV – station *C*

(3) seismogram I – station *C*  
seismogram II – station *B*  
seismogram III – station *D*  
seismogram IV – station *A*

(4) seismogram I – station *A*  
seismogram II – station *D*  
seismogram III – station *B*  
seismogram IV – station *C*

47 Station *D* is 8000 kilometers from the earthquake epicenter. How long did it take for the first *P*-wave to travel from the epicenter to station *D*?

(1) 9 minutes 20 seconds

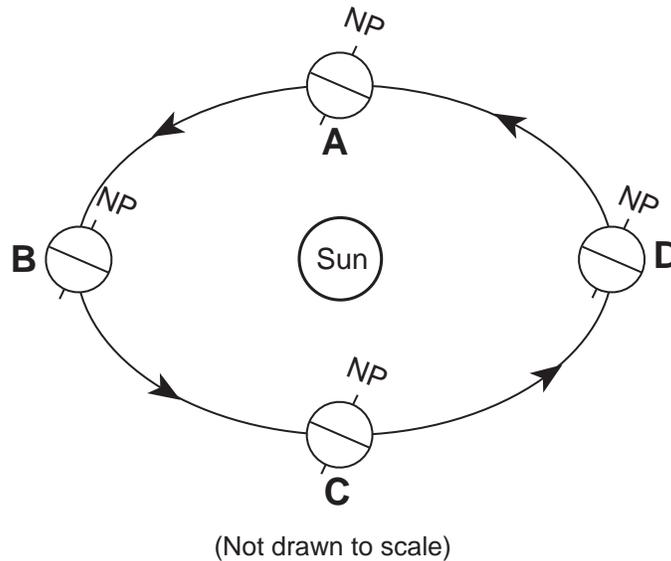
(2) 11 minutes 20 seconds

(3) 20 minutes 40 seconds

(4) 4 minutes 20 seconds

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Base your answers to questions 48 through 50 on the diagram below, which represents Earth revolving around the Sun. Letters *A*, *B*, *C*, and *D* represent Earth's location in its orbit on the first day of the four seasons. NP represents the North Pole.



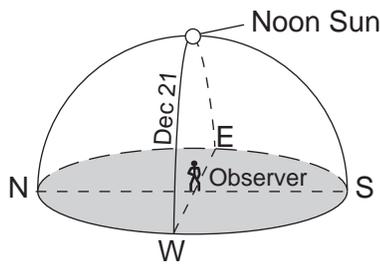
48 Which location in Earth's orbit represents the first day of summer in New York State?

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

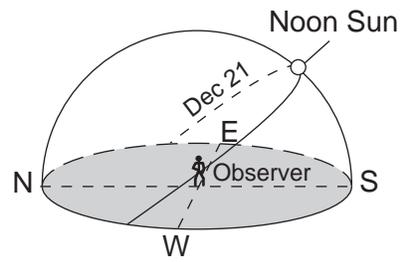
49 If the tilt of Earth's axis were decreased from  $23.5^\circ$  to  $15^\circ$ , New York State's winters would become

- (1) warmer, and summers would become cooler
- (2) warmer, and summers would become warmer
- (3) cooler, and summers would become cooler
- (4) cooler, and summers would become warmer

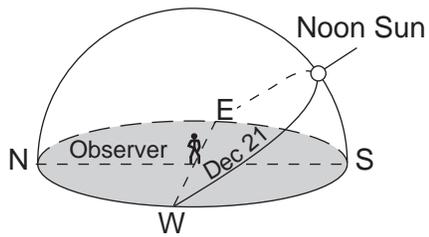
50 Which diagram best represents the Sun's apparent path as seen by an observer at  $43.5^\circ$  N latitude on December 21?



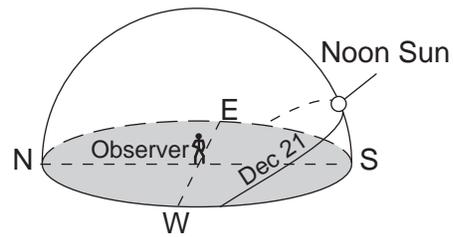
(1)



(3)



(2)



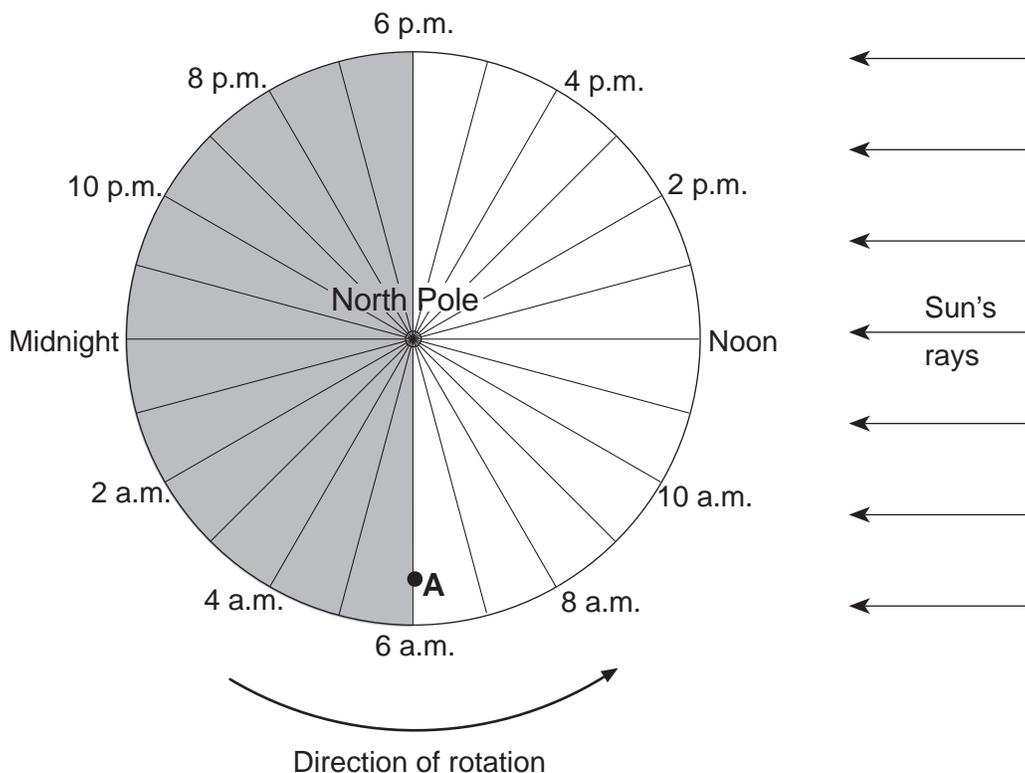
(4)

**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 53 on the diagram below, which represents a north polar view of Earth on a specific day of the year. Solar times at selected longitude lines are shown. Letter A represents a location on Earth's surface.



- 51 How many degrees apart are the longitude lines shown in the diagram? [1]
  - 52 State the altitude of *Polaris* as seen by an observer at the North Pole. [1]
  - 53 How many hours of daylight would an observer at location A experience on this day? [1]
-

Base your answers to questions 54 through 56 on the data table below. Six identical cylinders, A through F, were filled with equal volumes of sorted spherical particles. The data table shows the particle diameters, in centimeters, and the amount of time, in seconds, for water to flow equal distances through each cylinder.

**Data Table**

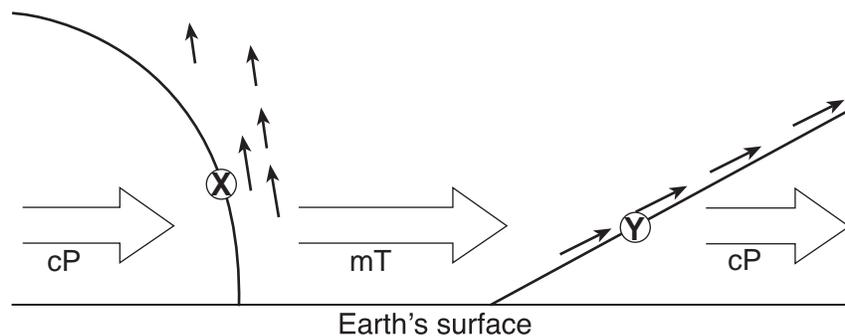
Cylinder	Particle Diameter (cm)	Flow Time (s)
A	0.07	51
B	0.08	39
C	0.10	25
D	0.14	13
E	0.16	10
F	0.18	8

54 Use the information in the data table to construct a line graph. On the grid in your answer booklet, plot the data for the flow time for each of the particle sizes given in the data table. Connect the plotted data with a smooth, curved line. [1]

55 Determine the flow time in a cylinder containing particles with a diameter of 0.13 centimeter. [1]

56 State *one* reason why the water flows faster through the cylinders containing larger particles than through the cylinders containing smaller particles. [1]

Base your answers to questions 57 through 59 on the cross section below, which shows two weather fronts moving across New York State. Lines X and Y represent frontal boundaries. The large arrows show the general direction the air masses are moving. The smaller arrows show the general direction warm, moist air is moving over the frontal boundaries.



57 Which type of front is represented by letter X? [1]

58 Explain why the warm, moist air rises over the frontal boundaries. [1]

59 Which type of front forms when front X catches and overtakes front Y? [1]

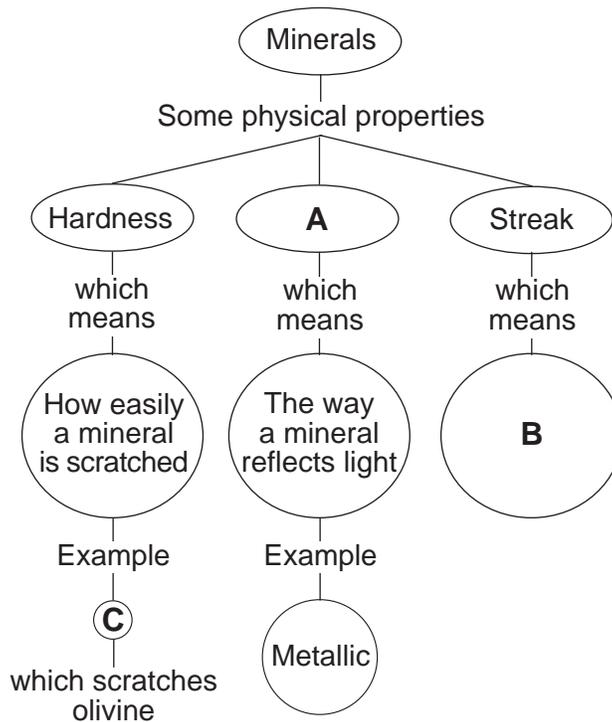
Base your answers to questions 60 through 62 on the diagram in your answer booklet, which shows the relative diameter sizes of the planets compared to the radius of the Sun.

60 On the diagram *in your answer booklet*, circle only the terrestrial planets. [1]

61 On the diagram *in your answer booklet*, place an **X** on the planet with the *lowest* density. [1]

**?** 62 How many times larger is the diameter of the Sun than the diameter of Jupiter? [1]

Base your answers to questions 63 through 65 on the chart below, which shows some physical properties of minerals and the definitions of these properties. The letters A, B, and C indicate parts of the chart that have been left blank. Letter C represents the name of a mineral.



**?** 63 Which physical property of a mineral is represented by letter A? [1]

**?** 64 State the definition represented by letter B. [1]

**?** 65 Identify *one* mineral that could be represented by letter C. [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 69 on the diagram in your answer booklet, which shows the Moon's orbit around Earth.

- 66 On the diagram *in your answer booklet*, place a small circle (○) on the Moon's orbit at the new-Moon phase where none of the lighted portion of the Moon is visible from Earth. [1]
- 67 Explain why ocean tides are considered to be cyclic. [1]
- 68 How long does it take the Moon to complete one revolution around Earth? Express your answer to the *nearest tenth of a day*. [1]
- 69 Explain why lunar eclipses only occur when the Moon and the Sun are on opposite sides of Earth. [1]
- 

Base your answers to questions 70 through 74 on the map in your answer booklet. The map shows the precipitation totals, in inches, from January 2003 through May 2003 for the North Carolina locations represented by dots. Precipitation totals for locations A and B are recorded on the map. The towns of Newport and Beaufort are labeled on the map.

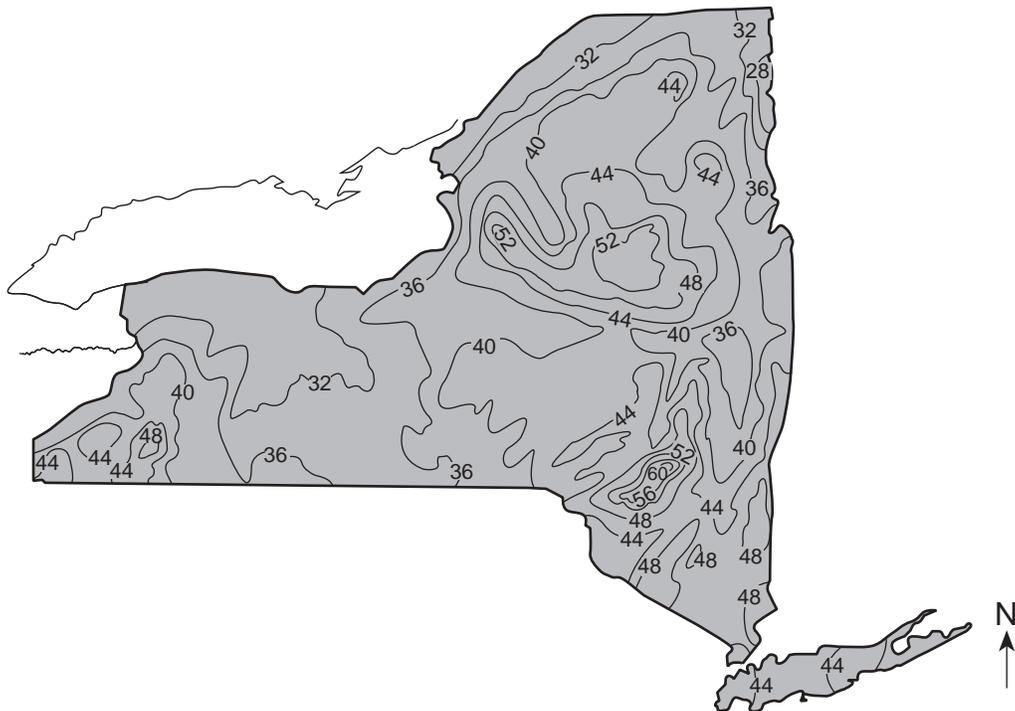
- 70 On the map *in your answer booklet*, use a smooth, curved line to draw the 25.00-inch precipitation isoline. The isoline must extend to the edges of the map. [1]
- 71 Calculate the rainfall gradient between locations A and B on the map to the *nearest hundredth*. Label your answer with the correct units. [1]
- 72 Identify the city shown on the *Generalized Bedrock Geology of New York State* map in the *Earth Science Reference Tables* that is closest to the longitude of Newport, North Carolina. [1]
- 73 Explain why the intensity of insolation received at Beaufort, North Carolina, on a clear day is greater than the intensity of insolation received at Buffalo, New York, on the same clear day. [1]
- 74 On the grid *in your answer booklet*, draw a line to show the general relationship between the amount of precipitation and the amount of runoff in Beaufort, North Carolina, if the ground is saturated. [1]
-

Base your answers to questions 75 through 79 on the passage and map below. The map shows the average yearly precipitation in New York State measured in inches.

### Landscapes and Precipitation

Moisture from the Gulf of Mexico and the Atlantic Ocean is carried to New York State by storm systems and air currents. Rain and snowfall amounts vary by region. Heavy snow belts are located near Lake Erie and Lake Ontario as well as in the plateau regions of eastern and northern New York State. Long Island and New York City usually experience lighter snowfalls. Snowfall amounts are converted to inches of water to determine yearly precipitation.

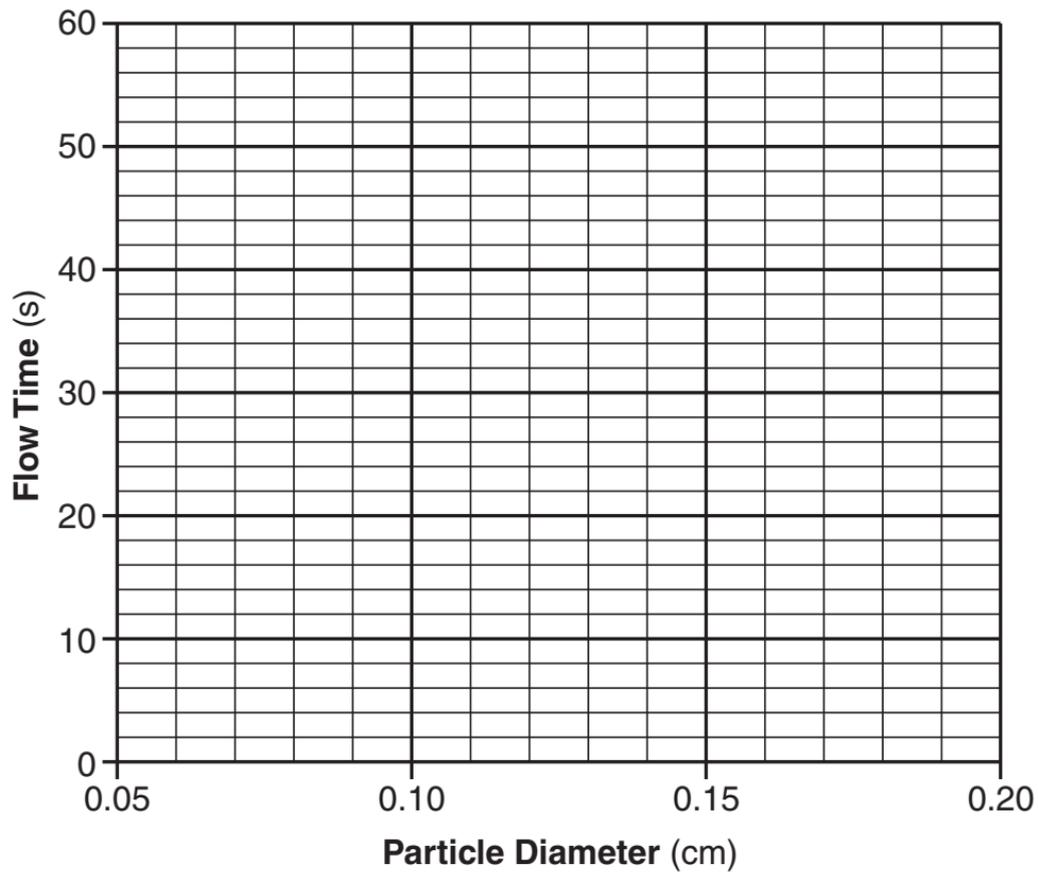
### Average Yearly Precipitation in Inches



- 75 Identify *two* bodies of water that are major sources of moisture for the precipitation that occurs in New York State. [1]
- 76 Identify the New York State landscape region that has the greatest average yearly amount of precipitation. [1]
- 77 Identify *one* process that occurs in rising air that produces clouds from water vapor. [1]
- 78 On the map *in your answer booklet*, draw *one* arrow to show the path that air travels to produce heavy lake-effect snowfall in Oswego, New York. [1]
- 79 Describe *two* actions that could be taken to prepare for a forecasted severe snow event. [1]
-

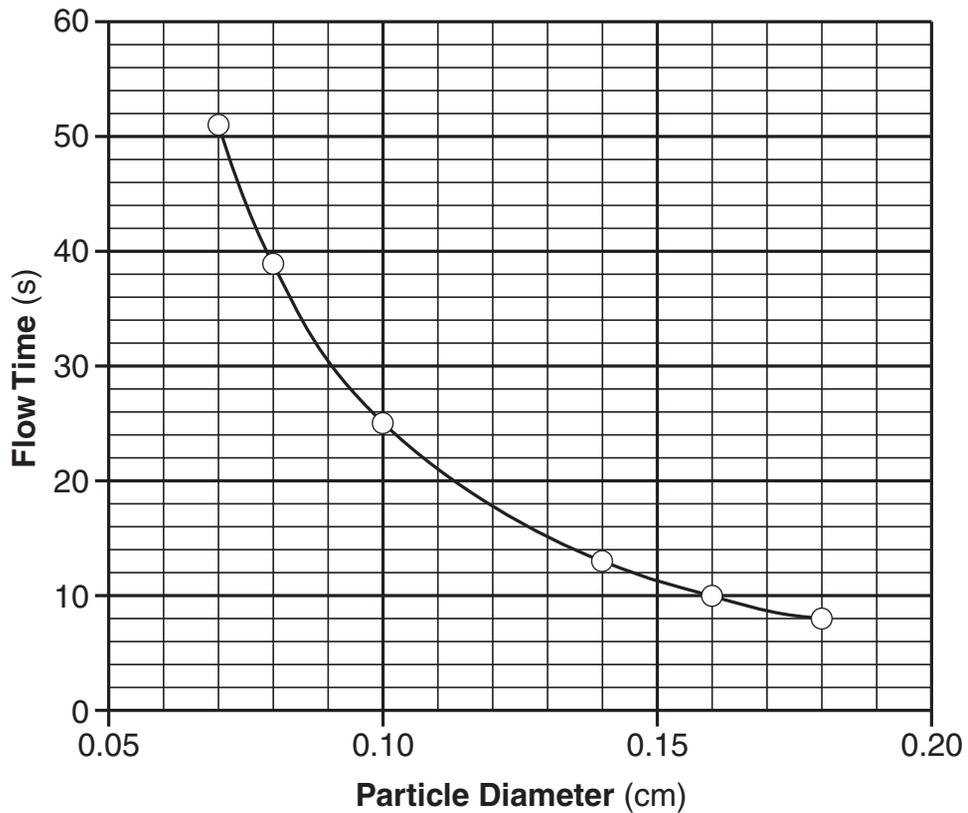
Base your answers to questions 80 through 85 on the geologic cross section in your answer booklet. Rock units *A* through *H* are shown. Several rock units contain fossils. Rock unit *G* was formed in a zone of contact metamorphism.

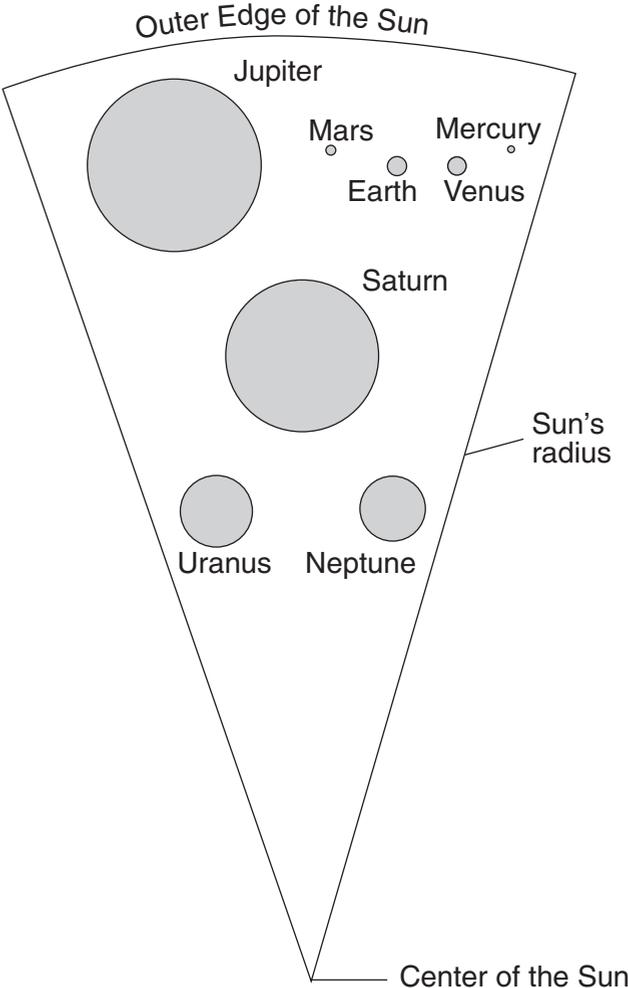
- 80 Place *two* **Xs** on the cross section *in your answer booklet* to show the locations of *two* unconformities that formed at different times in geologic history. [1]
-  81 Identify *two* possible geologic periods during which the sediments that formed rock unit *E* could have been deposited. [1]
-  82 Describe the evidence shown in the cross section that indicates that rock unit *C* is younger than rock unit *D*. [1]
-  83 Identify the letter of the rock unit that was formed at the same time as igneous rock unit *H*. [1]
-  84 Identify *one* geologic period during which igneous intrusion *H* could have formed. [1]
-  85 Explain why the absolute age of the fossils shown in the cross section can *not* be determined by using radioactive carbon-14. [1]
-



54 [1] Allow 1 credit for a correctly drawn line that passes within all of the circles shown below.

**Note:** It is recommended that an overlay be used to ensure reliability in rating.

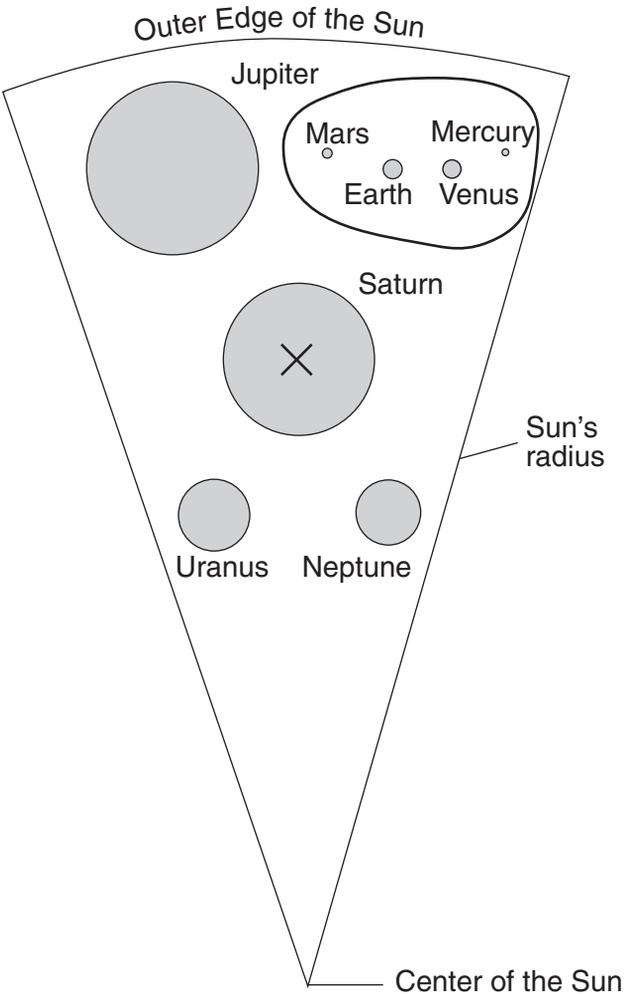


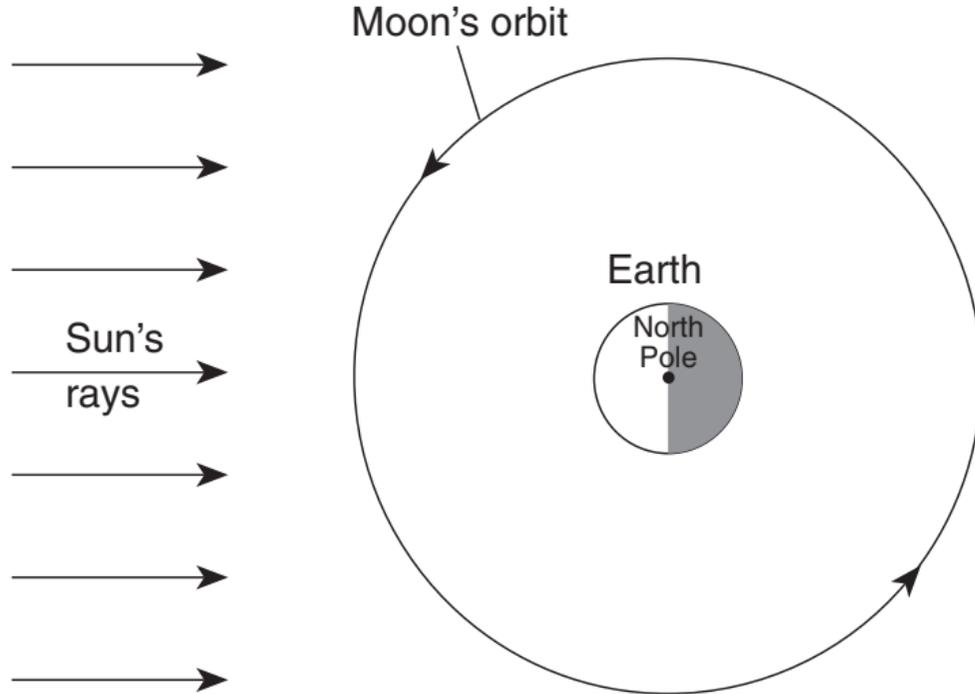


60 [1] Allow 1 credit for circling Mercury, Venus, Earth, and Mars.

61 [1] Allow 1 credit for placing an **X** on Saturn.

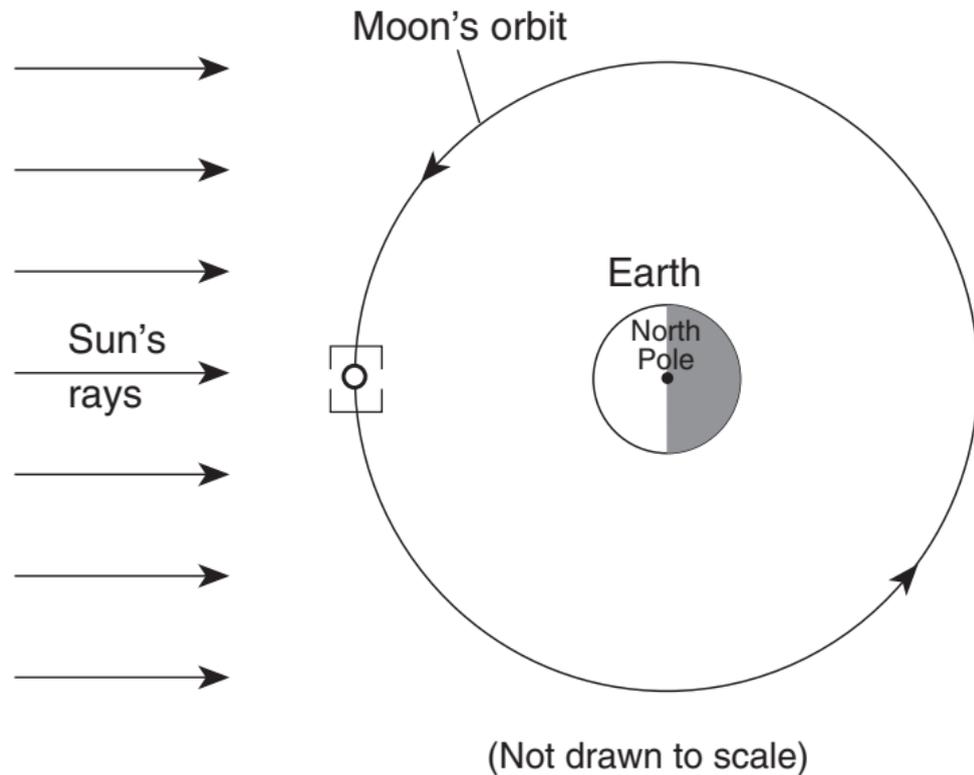
**Example of a 2-credit response for questions 60 and 61:**

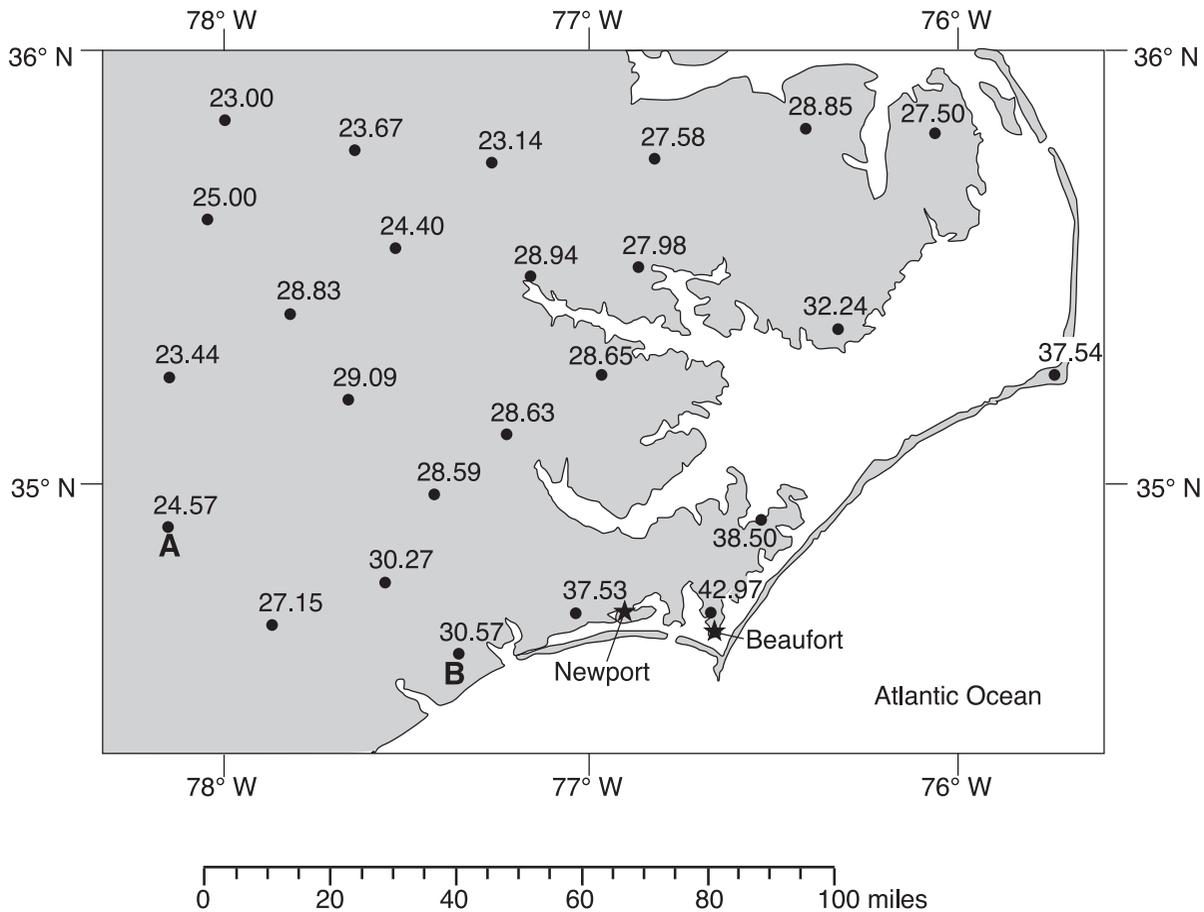




(Not drawn to scale)

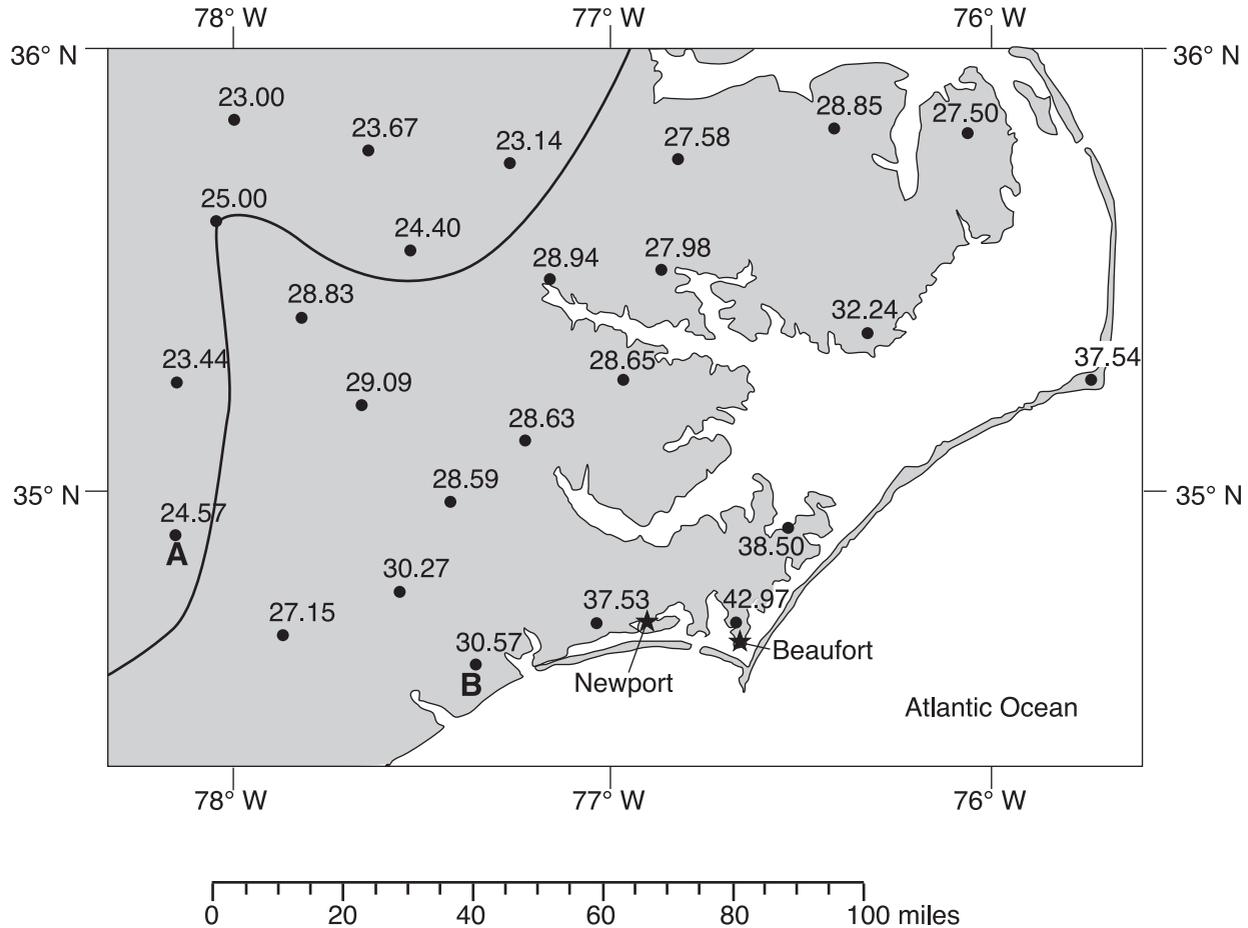
**66** [1] Allow 1 credit if the center of the student-drawn circle is within the brackets shown.

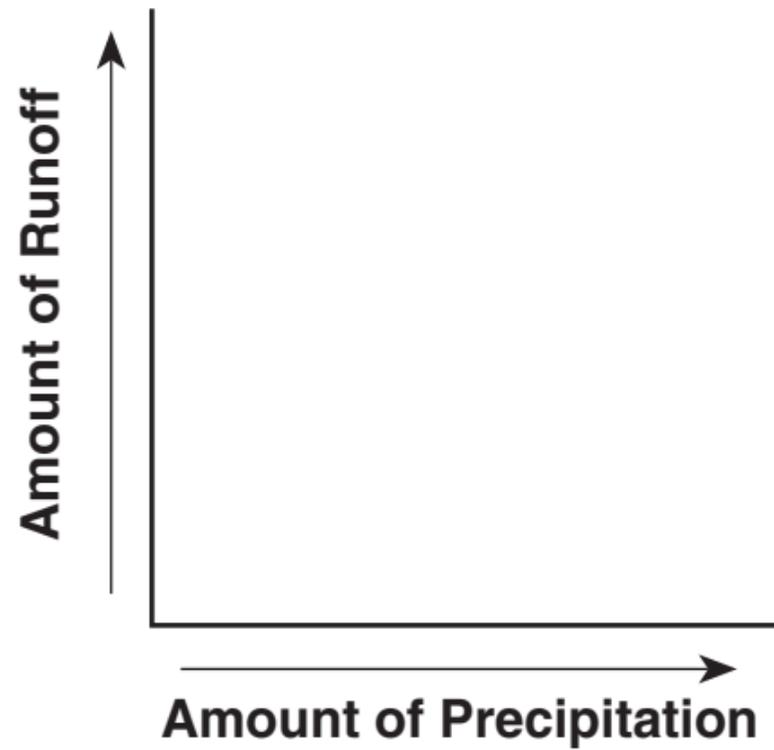




- 70 [1] Allow 1 credit for a correctly drawn 25.00-inch isoline that extends to the edges of the map. If more than one isoline is drawn, all isolines must be correct to receive credit.

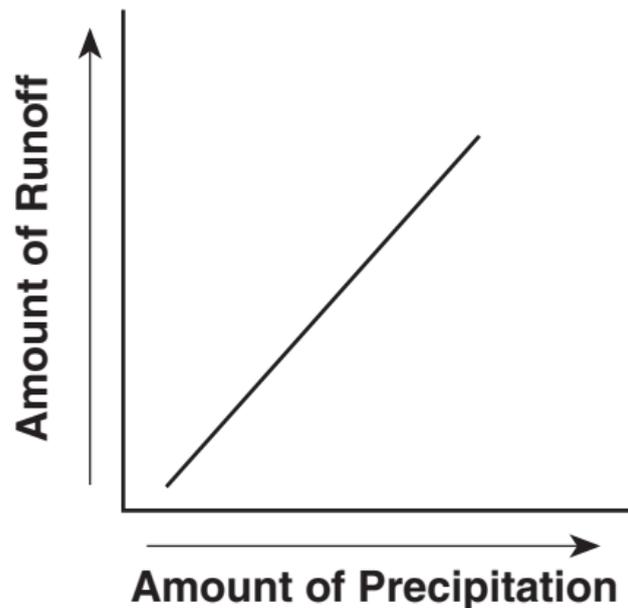
**Example of a 1-credit response:**





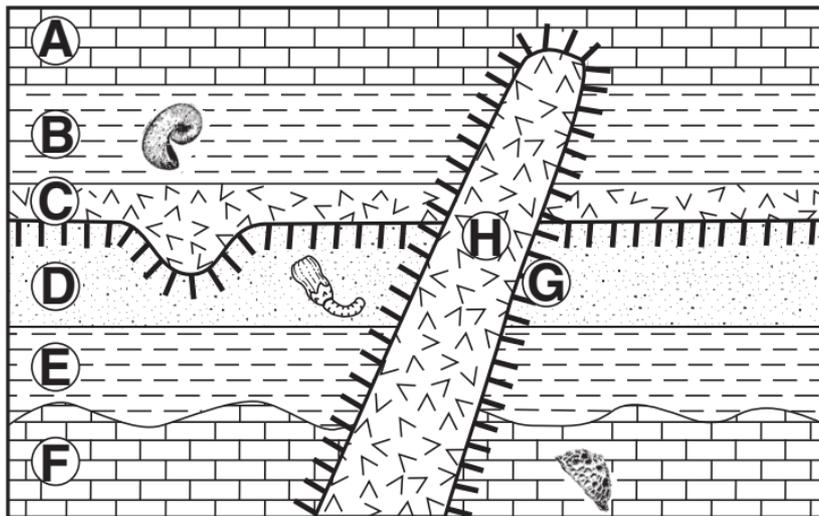
**74** [1] Allow 1 credit for a graph showing a direct relationship. A straight or curved line may be used.

**Example of a 1-credit response:**









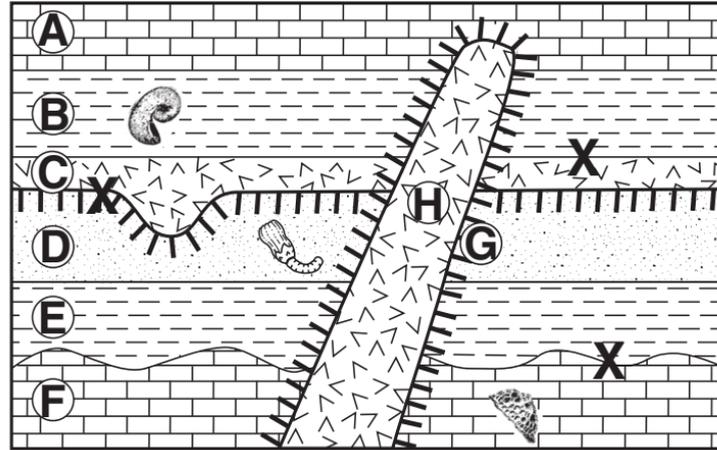
## Key



Igneous rock

Contact  
metamorphismAmmonoid  
(Cretaceous Period)Crinoid  
(Mississippian Period)Coral  
(Devonian Period)

80 [1] Allow 1 credit if *two* **X**s are located on *two* of the three boundaries shown below. Do *not* allow credit if both **X**s are along the same unconformity.



Key	
	Igneous rock
	Contact metamorphism
	Ammonoid (Cretaceous Period)
	Crinoid (Mississippian Period)
	Coral (Devonian Period)