

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

EARTH SCIENCE

Thursday, August 12, 1999 — 12:30 to 3:30 p.m., only

The last page of the booklet is the answer sheet. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of your answer sheet.

All of your answers are to be recorded on the separate answer sheet. For each question, decide which of the choices given is the best answer. Then on the answer sheet, in the row of numbers for that question, circle with pencil the number of the choice that you have selected. The sample below is an example of the first step in recording your answers.

SAMPLE: (1) 2 3 4

If you wish to change an answer, erase your first penciled circle and then circle with pencil the number of the answer you want. After you have completed the examination and you have decided that all of the circled answers represent your best judgment, signal a proctor and turn in all examination material except your answer sheet. Then and only then, place an X in ink in each penciled circle. Be sure to mark only one answer with an X in ink for each question. No credit will be given for any question with two or more X's marked. The sample below indicates how your final choice should be marked with an X in ink.

SAMPLE: (X) 2 3 4

The *Earth Science Reference Tables*, which you may need to answer some questions in this examination, are supplied separately. Be certain you have a copy of the 1994 edition of these reference tables before you begin the examination.

When you have completed the examination, you must sign the statement printed at the end of the 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 cannot be accepted if you fail to sign this declaration.

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

Part I

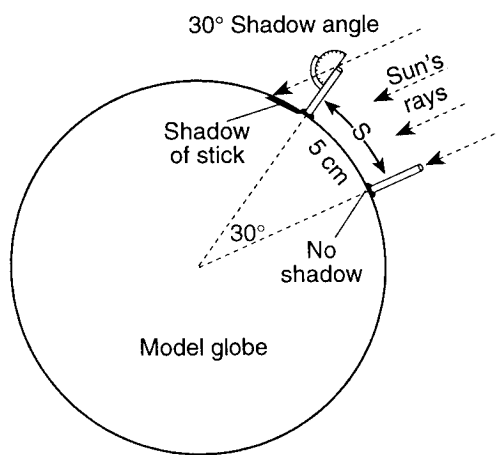
Answer all 55 questions in this part. [55]

Directions (1–55): For each statement or question, select the word or expression that, of those given, best completes the statement or answers the question. Record your answer on the separate answer sheet in accordance with the directions on the front page of this booklet. Some questions may require the use of the *Earth Science Reference Tables*.

- 1 An example of noncyclic change is the occurrence of
 - 1 earthquakes
 - 2 ocean tides
 - 3 the phases of the Moon
 - 4 the seasons of the year

- 2 Which action can be performed most accurately using only the human senses?
 - 1 tearing a sheet of paper into squares whose sides measure 1 centimeter
 - 2 adding 10 grams of salt to a cup of water
 - 3 measuring the air pressure of a room
 - 4 counting 28 shells from a beach

3 The diagram below illustrates an Earth science laboratory investigation used for determining the circumference of a model globe. The distance (S) between the two sticks is 5 centimeters. One of the sticks produces no shadow on the globe, indicating that the Sun is directly over it. The other stick produces a shadow having an angle of 30° .



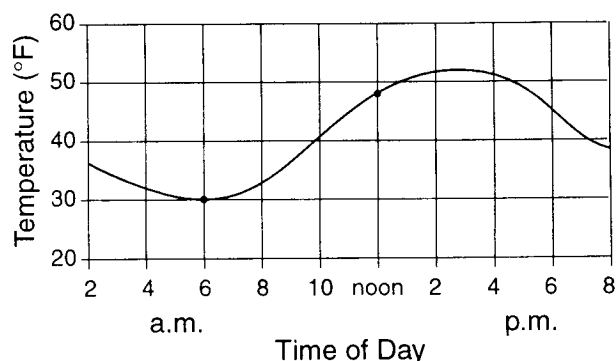
(Not drawn to scale)

What is the circumference of the model globe?

- | | |
|-----------|------------|
| (1) 18 cm | (3) 72 cm |
| (2) 60 cm | (4) 150 cm |

- 4 A black hole is a celestial feature believed to have a mass millions of times the mass of our Sun and a diameter less than the diameter of Earth. An object of such high mass and small volume would have
 - 1 a very low density
 - 2 a very high density
 - 3 an elliptical orbit with the Sun at one focal point
 - 4 an elliptical orbit with Earth at one focal point

- 5 The graph below shows temperature readings for a day in April.

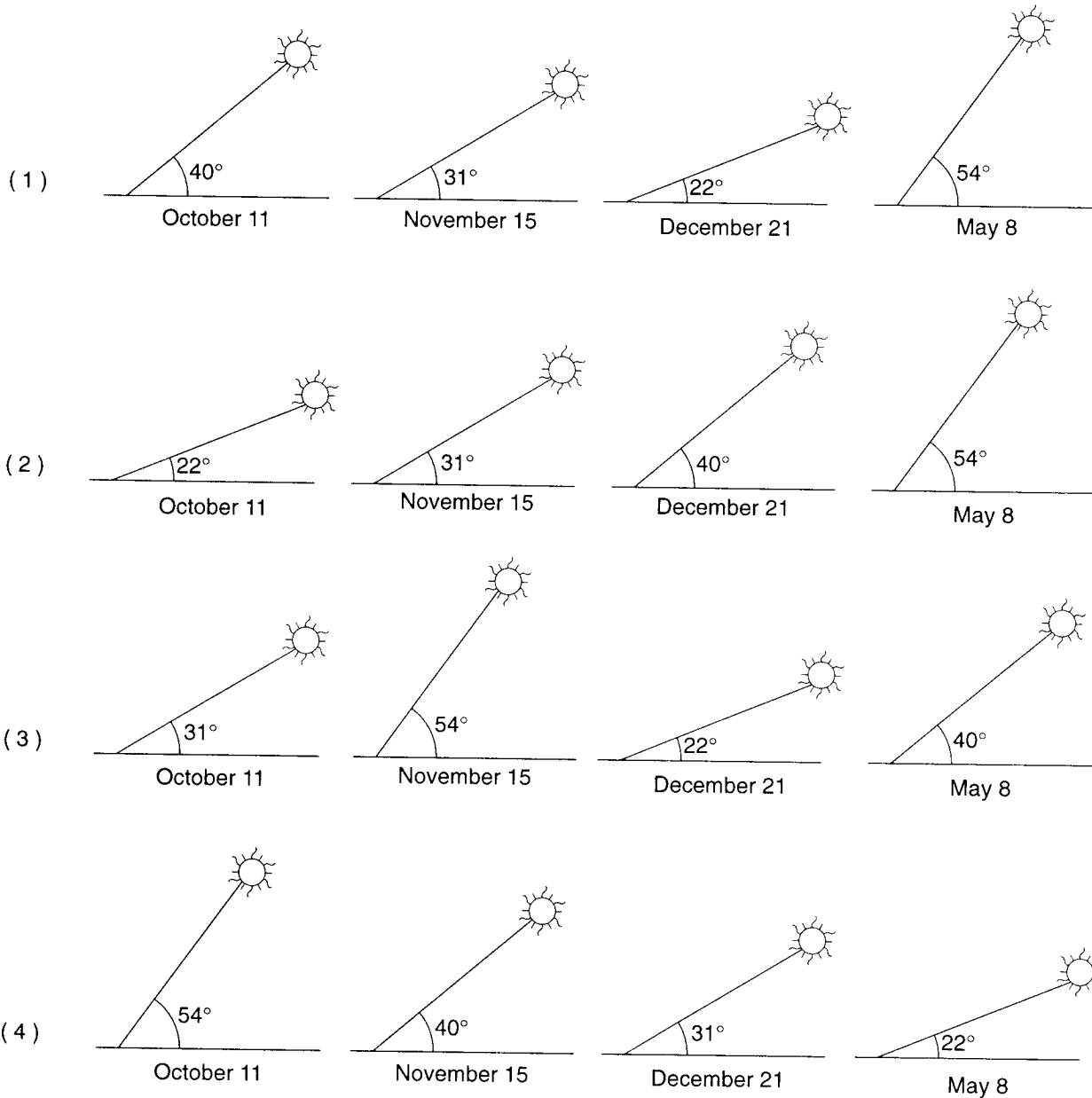


The average rate of temperature change, in Fahrenheit degrees per hour, between 6 a.m. and noon was

- | | |
|-------------------------|--------------------------|
| (1) $6^\circ/\text{hr}$ | (3) $3^\circ/\text{hr}$ |
| (2) $8^\circ/\text{hr}$ | (4) $18^\circ/\text{hr}$ |

- 6 A rock sample has a mass of 16 grams and a volume of 8 cubic centimeters. When the rock is cut in half, what is the volume and density of each piece?
 - (1) 8 cm^3 and 0.5 g/cm^3
 - (2) 8 cm^3 and 1.0 g/cm^3
 - (3) 4 cm^3 and 2.0 g/cm^3
 - (4) 4 cm^3 and 4.0 g/cm^3

7 A student accurately measured the altitude of the noontime Sun from the same New York State location on four days during the school year. Which sequence best shows these measurements?



8 When observed from a location in New York State for one night, the North Star (Polaris) appears to

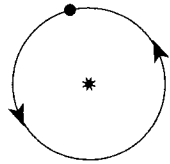
- 1 rise in the east and set in the west
- 2 rise in the west and set in the east
- 3 move southward along an arc-shaped path
- 4 remain stationary in the sky

9 A Foucault pendulum appears to change its direction of swing due to the

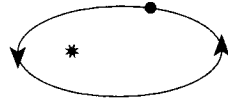
- 1 tilt of Earth's axis
- 2 spin of Earth on its axis
- 3 deflection of Earth's planetary winds
- 4 movement of Earth in its orbit around the Sun

10 Which diagram shows a planet with the *least* eccentric orbit?

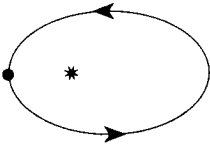
(Key: ● = planet * = star)



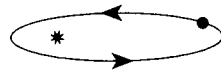
(1)



(3)



(2)

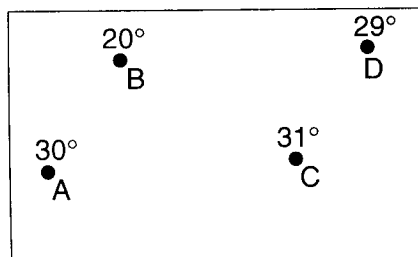


(4)

11 Which latitude and longitude coordinates represent a location on the continent of Australia?

- (1) 20° N, 135° E (3) 20° S, 135° E
 (2) 20° N, 135° W (4) 20° S, 135° W

12 The map below shows four locations in a temperature field. The temperature of each location is given in degrees Celsius.



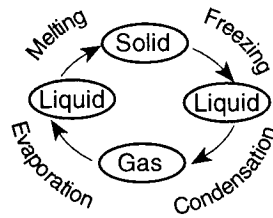
Heat energy will normally flow from

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

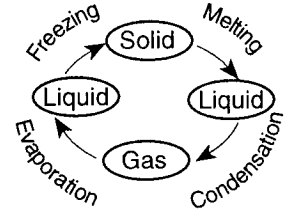
13 The *lowest* surface air temperatures in the Southern Hemisphere usually occur during the month of

- 1 January 3 July
 2 April 4 October

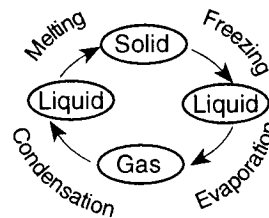
14 Which diagram correctly shows the processes that change the states of matter?



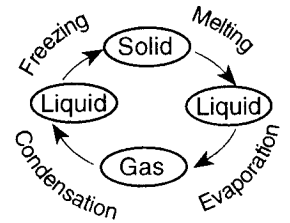
(1)



(3)

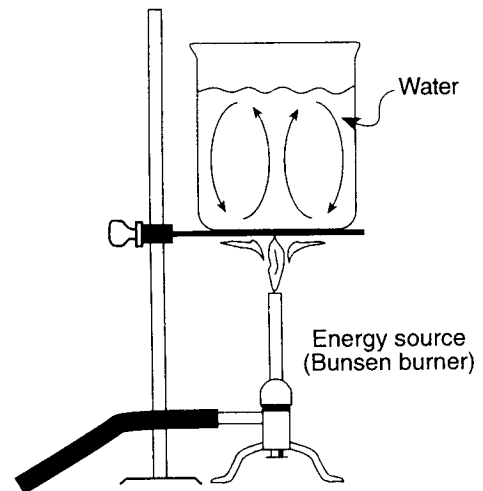


(2)



(4)

15 The diagram below shows the heating of water.



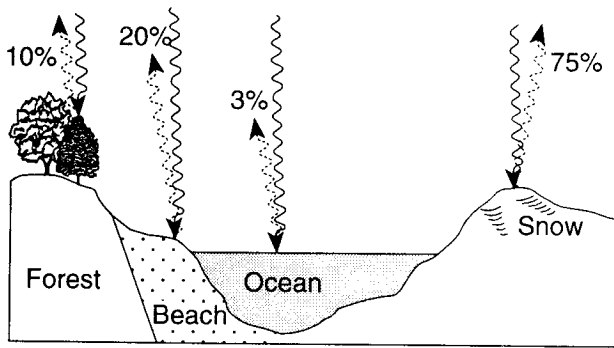
The main method of heat transfer occurring within the water is called

- 1 conduction 3 radiation
 2 convection 4 insolation

16 Most of the energy radiated by Earth's surface at night is in the form of

- (1) infrared rays (3) visible light rays
 (2) ultraviolet rays (4) x rays

- 17 The diagram below shows the percentage of sunlight reflected by different Earth surfaces when the Sun is directly overhead.



Key

Sunlight
 Reflected sunlight

Which material reflects the *least* sunlight?

- | | |
|----------|---------|
| 1 forest | 3 ocean |
| 2 beach | 4 snow |
- 18 On which two dates could all locations on Earth have equal hours of day and night?
- 1 September 23 and December 21
 - 2 December 21 and March 21
 - 3 March 21 and June 21
 - 4 March 21 and September 23

19 The weather characteristics of an air mass result primarily from its

- 1 geographic origin
- 2 size and shape
- 3 rate of movement
- 4 direction of movement

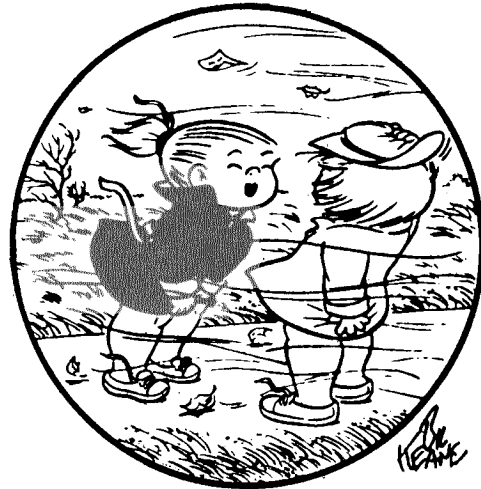
20 What is the relative humidity of a sample of air that has a dry-bulb temperature of 20°C and a wet-bulb temperature of 11°C?

- | | |
|--------|---------|
| (1) 9% | (3) 17% |
| (2) 2% | (4) 30% |

21 Most surface ocean currents are caused by

- | | |
|---------------|------------------------|
| 1 tides | 3 prevailing winds |
| 2 evaporation | 4 salinity differences |

- 22 The cartoon below shows a strong wind blowing from right to left.

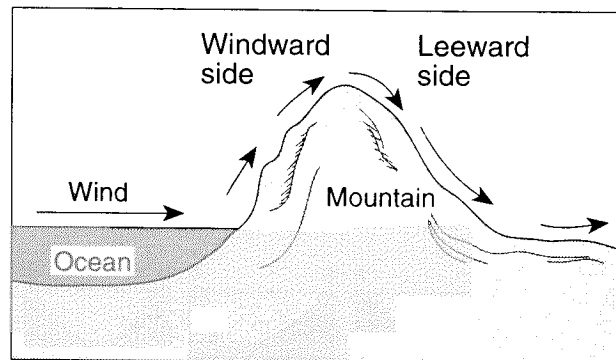


"Wind is the same as a breeze, only pushier."

The wind is blowing from right to left because the region to the right has a higher

- | | |
|-------------------|---------------------|
| 1 air temperature | 3 relative humidity |
| 2 air pressure | 4 elevation |

- 23 The diagram below shows the flow of planetary winds over a mountain ridge.



As air rises on the windward side of the mountain ridge, the air's temperature decreases. Which process usually causes this temperature decrease?

- 1 expansion of rising air
- 2 compression of rising air
- 3 precipitation from clouds
- 4 evaporation from clouds

24 Which process occurs when water vapor moves out of the leaves of a tree into the atmosphere?

- 1 condensation
- 2 infiltration
- 3 runoff
- 4 transpiration

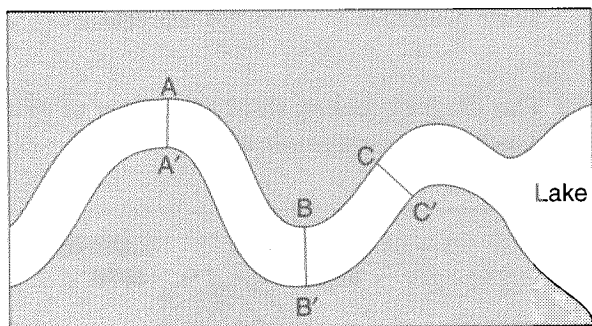
25 Which type of weather is indicated by closely spaced isobars on a weather map?

- 1 calm conditions
- 2 strong winds
- 3 thick clouds
- 4 clear skies

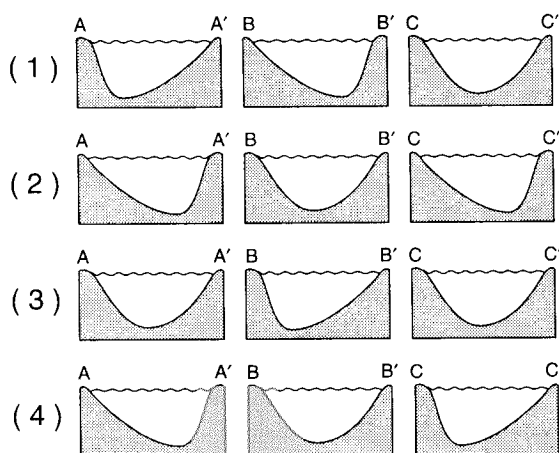
26 Which soil condition allows the most infiltration of precipitation?

- 1 saturated soil
- 2 a steep soil surface
- 3 coarse-grained soil
- 4 an impermeable surface

27 The map below represents a meandering stream flowing into a lake. A student measured water depths in the stream at three locations: A-A', B-B', and C-C'.



Which set of cross sections best represents the streambed at the three locations?



28 Which two climate factors are most directly responsible for the amount of snowfall normally received in Buffalo, New York?

- 1 ocean currents and storm tracks
- 2 mountain barriers and average temperatures
- 3 elevation and potential evapotranspiration
- 4 prevailing wind direction and nearness to a large body of water

29 The planetary wind and moisture belts indicate that large amounts of rainfall occur at Earth's Equator because air is

- 1 converging and rising
- 2 converging and sinking
- 3 diverging and rising
- 4 diverging and sinking

30 Soil horizons develop as a result of

- 1 evaporation and transpiration
- 2 compacting and cementing
- 3 weathering and biological activity
- 4 faulting and folding

31 A decrease in a river's velocity will most likely result in more

- 1 erosion by the river
- 2 deposition within the river
- 3 large particles being carried by the river
- 4 dissolved material being picked up by the river

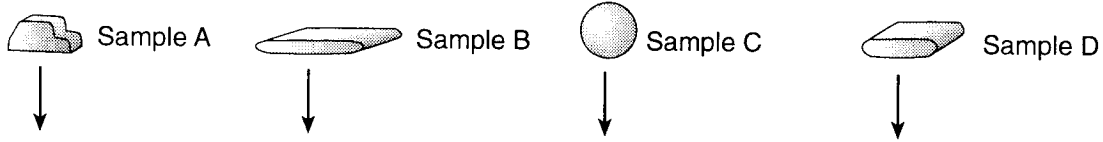
32 The crystals of many metamorphic rocks are aligned in bands as a result of

- 1 earthquake faulting
- 2 cooling and solidification
- 3 mechanical weathering
- 4 heat and pressure

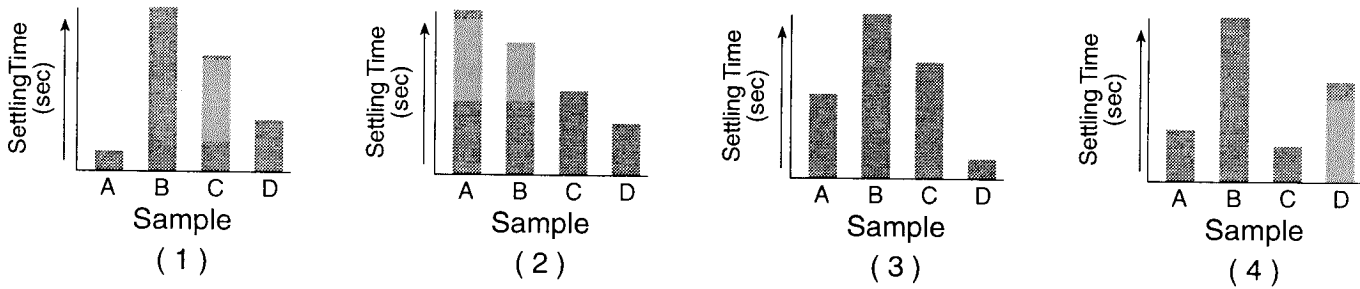
33 Which rock type is found as surface bedrock in the Finger Lakes region of New York State?

- 1 igneous
- 2 sedimentary
- 3 contact metamorphic
- 4 regional metamorphic

34 Four differently shaped samples of equal mass and density are dropped into still water. The diagrams below indicate the position of each sample as it settles.



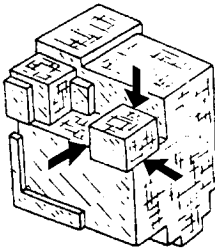
Which graph best shows the relationship of the settling time of the four samples?



35 A sedimentary deposit produced by wind erosion is most likely composed of

- 1 sorted fine-grained particles in cross-bedded layers
- 2 a range of particle sizes from 1.0 to 10.0 cm in diameter in thick layers
- 3 flat, angular boulders in unsorted piles
- 4 shells of varying size, shape, and composition in isolated mounds

36 The diagram below shows a broken crystal of the mineral halite.



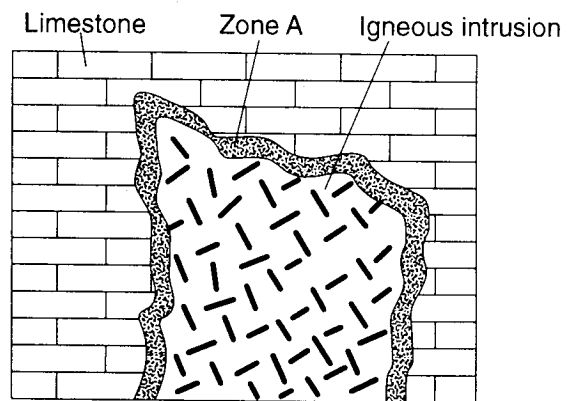
The shape of the halite crystal is a direct result of the

- 1 internal arrangement of the atoms in the crystal
- 2 temperature at which the crystal formed
- 3 type of surface on which the crystal formed
- 4 stream erosion that changed the crystal

37 Which sedimentary rocks are clastic and consist of particles that have diameters smaller than 0.006 centimeter?

- 1 conglomerate and sandstone
- 2 siltstone and shale
- 3 bituminous coal and breccia
- 4 fossil limestone and chemical limestone

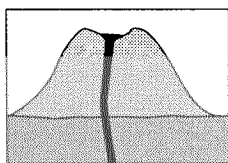
38 The geologic cross section below shows limestone that was intruded. Part of the limestone (zone A) was heated intensely but was not melted.



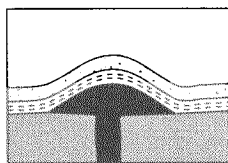
Which type of rock most likely formed in zone A?

- 1 gneiss
- 2 slate
- 3 marble
- 4 obsidian

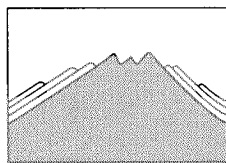
Base your answers to questions 39 and 40 on the geologic cross sections below, which represent bedrock from different areas on Earth.



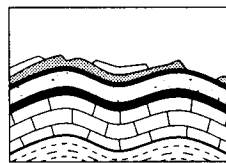
A



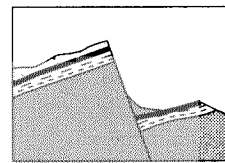
B



C



D



E

39 All the cross sections most likely represent areas of

- 1 crustal stability
- 2 mountain building
- 3 seashore erosion
- 4 plateau development

40 Organizing information in a meaningful way, such as grouping these cross sections, is an example of

- | | |
|---------------|------------------|
| 1 prediction | 3 observation |
| 2 measurement | 4 classification |

41 A seismic station received the *P*-waves generated by an earthquake but did not receive the *S*-waves. Which statement best explains the absence of the *S*-waves?

- 1 The earthquake was too weak to produce *S*-waves.
- 2 The earthquake's epicenter and focus were at the same location.
- 3 The *S*-waves were absorbed by a fluid layer as they traveled toward the seismic station.
- 4 The *S*-waves were reflected away from the seismic station when they reached the Moho interface.

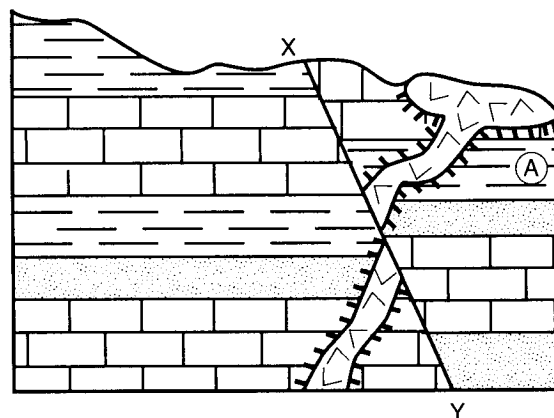
42 Which difference between gabbro bedrock and granite bedrock causes seismic waves to travel faster in gabbro than in granite?

- 1 Gabbro is more dense than granite.
- 2 Gabbro has greater permeability than granite.
- 3 Gabbro has a darker color than granite.
- 4 Gabbro is made of smaller mineral grains than granite.

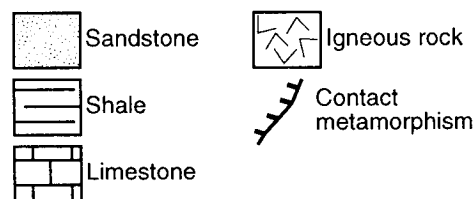
43 Which animals do scientists believe could have been hunted by humans, based on evidence such as stone spearpoints found embedded in the animals' bones?

- | | |
|-------------|------------------|
| 1 dinosaurs | 3 armored fishes |
| 2 mammoths | 4 trilobites |

44 A geologic cross section for a portion of Earth's crust is shown below. Letter A is a location in a rock layer, and line XY represents a fault.



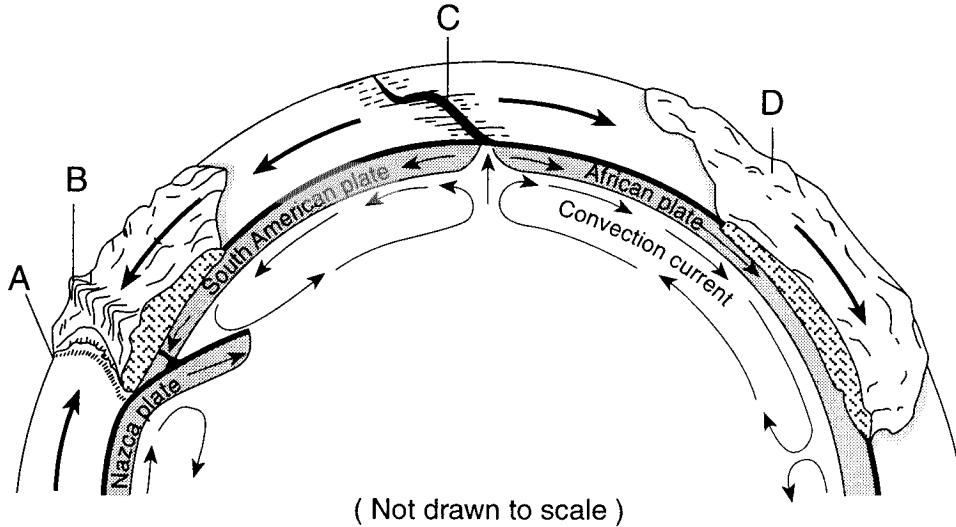
Key



Which of these events occurred most recently at this location?

- 1 deposition of the layer at A
- 2 igneous intrusion
- 3 contact metamorphism
- 4 faulting along line XY

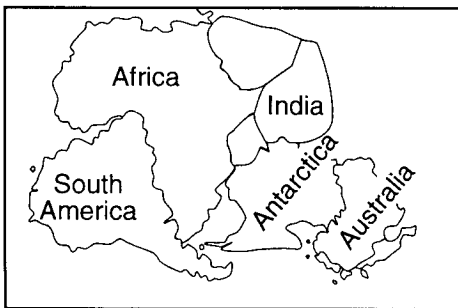
45 The diagram below shows a cross section of a portion of Earth. The inferred motions of crustal plates are shown. Letters A through D represent locations at Earth's surface.



Which letter represents the location of the mid-Atlantic Ridge?

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

46 The diagram below shows how scientists think some of Earth's continents were joined together in the geologic past.



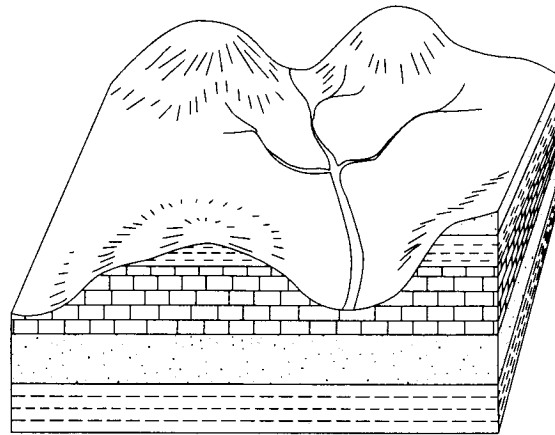
When do scientists think these continents were joined together?

- 1 during the Tertiary Period, only
- 2 from the Cretaceous Period through the Tertiary Period
- 3 from the Devonian Period through the Triassic Period
- 4 during the Cambrian Period, only

47 Fossils would most likely be found in a sample of

- 1 limestone
- 2 granite
- 3 quartzite
- 4 metaconglomerate

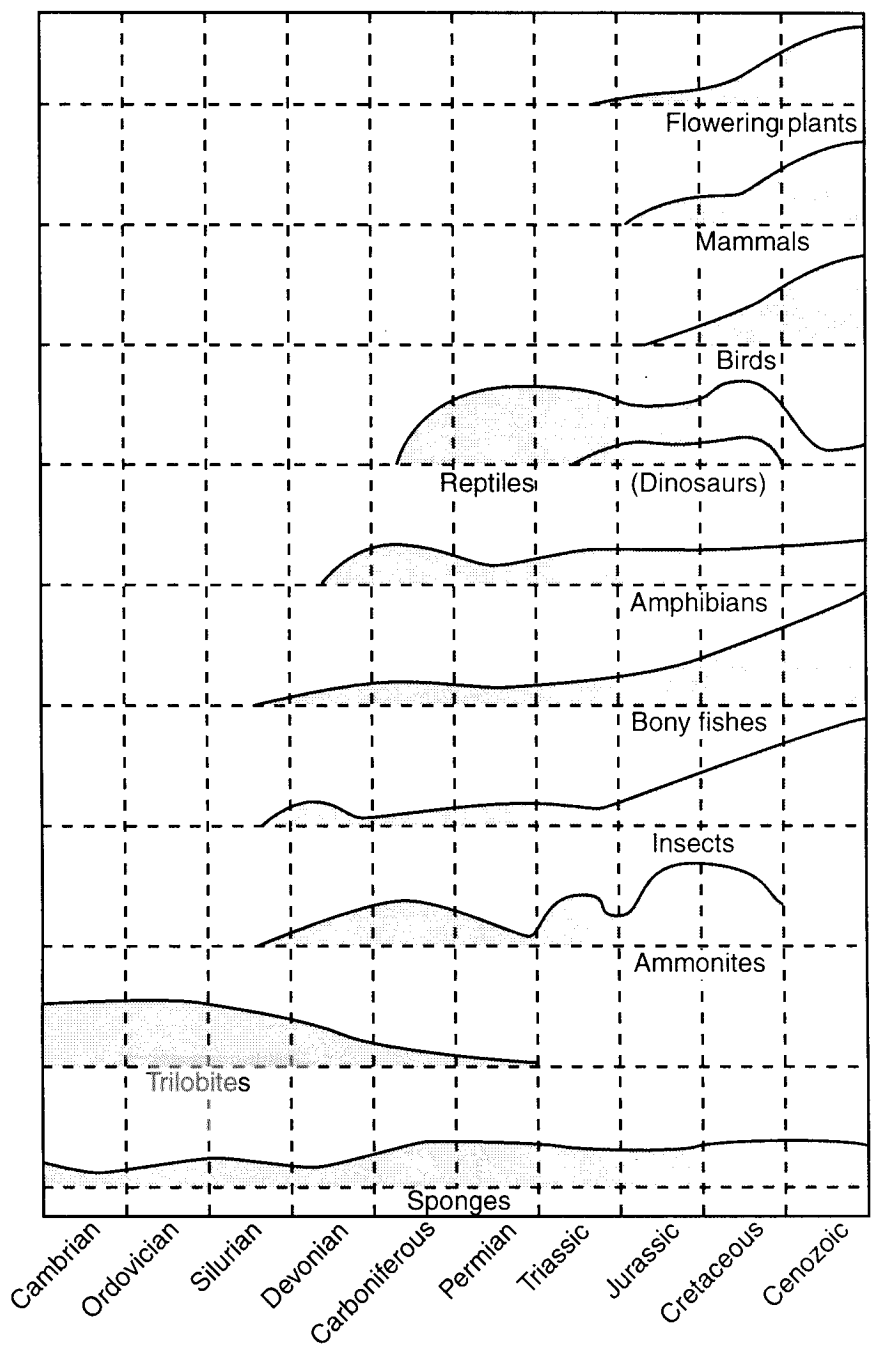
48 The geologic cross section below shows surface landscape features that developed because of a humid climate.



Which change will eventually be observed if the climate of the area becomes very arid?

- 1 The rate of chemical weathering will increase.
- 2 The elevation of the entire region will increase.
- 3 The landscape will gradually become more rounded.
- 4 The slopes will gradually become steeper and more angular.

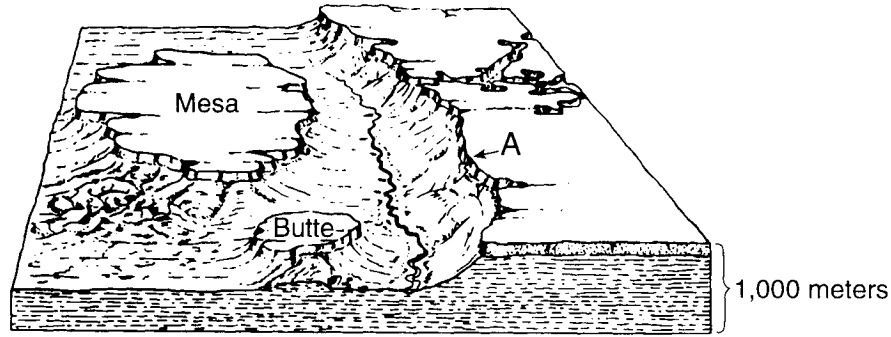
Base your answers to questions 49 and 50 on the chart below. The thickness of the shaded areas shows the relative abundance of some animals and plants through geologic time.



- 49 Which life-forms appear to be extinct?
- 1 sponges, insects, and flowering plants
 - 2 bony fishes, dinosaurs, and mammals
 - 3 sponges, insects, and reptiles
 - 4 trilobites, ammonites, and dinosaurs

- 50 Which life-form was most abundant 250 million years ago?
- 1 dinosaurs
 - 2 reptiles
 - 3 bony fishes
 - 4 trilobites

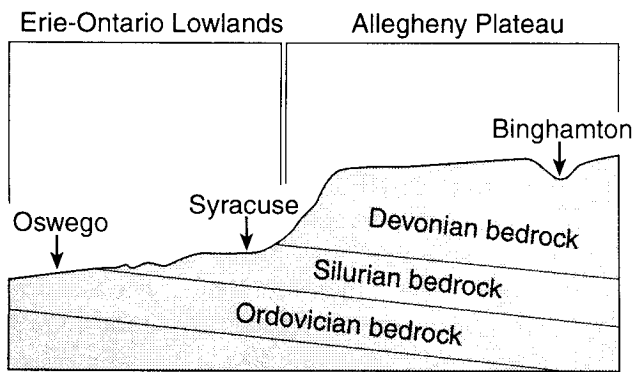
Base your answers to questions 51 and 52 on the diagram below, which shows part of a landscape region. Letter A indicates a steep cliff formed at the edge of the surface rock layer.



- 51 Which statement best explains why the steep cliff formed at A?
- 1 The surface layer is older than the rock layers below.
 - 2 The surface layer was deposited as loose volcanic ash.
 - 3 The surface layer is more resistant to weathering than the other layers.
 - 4 The surface layer contains many fossils.

- 52 In which type of landscape region is this area located?
- | | |
|-----------|----------------|
| 1 plateau | 3 mountain |
| 2 plain | 4 alluvial fan |

- 53 The cross section below shows the rock ages and landscape regions from Oswego to Binghamton, New York.



(Not drawn to scale)

Which factor determines the location of the boundary between the two landscape regions shown?

- 1 the amount of exposure the rock layers have on Earth's surface
- 2 a large difference in elevation
- 3 a fault
- 4 an unconformity

- 54 Which two elements are most useful for the radioactive dating of recent organic remains?
- | | |
|----------------------------|------------------------------|
| (1) C^{14} and N^{14} | (3) U^{238} and Pb^{206} |
| (2) K^{40} and Ca^{40} | (4) Rb^{87} and Sr^{87} |

- 55 Which two locations are found in the same New York State landscape region?
- 1 Old Forge and Utica
 - 2 Niagara Falls and Watertown
 - 3 Kingston and Rochester
 - 4 Plattsburgh and Ithaca

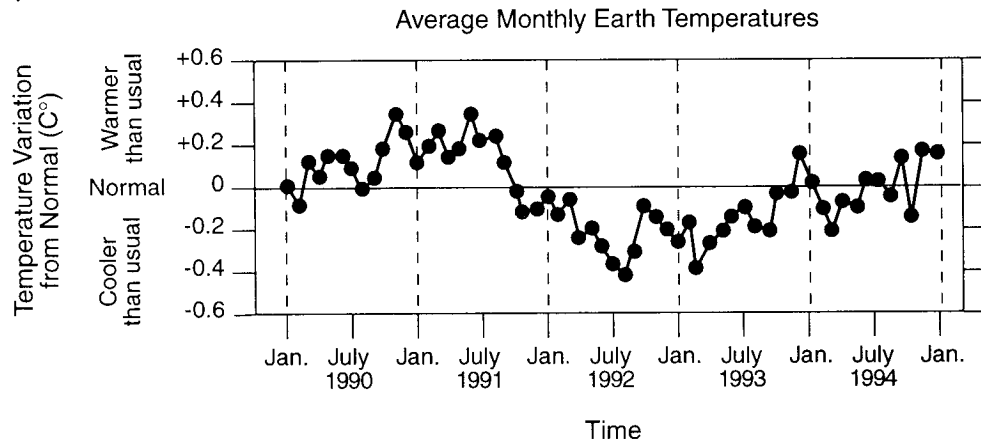
Part II

This part consists of ten groups, each containing five questions. Choose seven of these ten groups. Be sure that you answer all five questions in each group chosen. Record the answers to these questions on the separate answer sheet in accordance with the directions on the front page of this booklet. [35]

Group 1

If you choose this group, be sure to answer questions 56–60.

Base your answers to questions 56 through 60 on the graph below and on your knowledge of Earth science. The graph shows variations in Earth's monthly temperatures from normal Earth temperatures between January 1990 and January 1995.

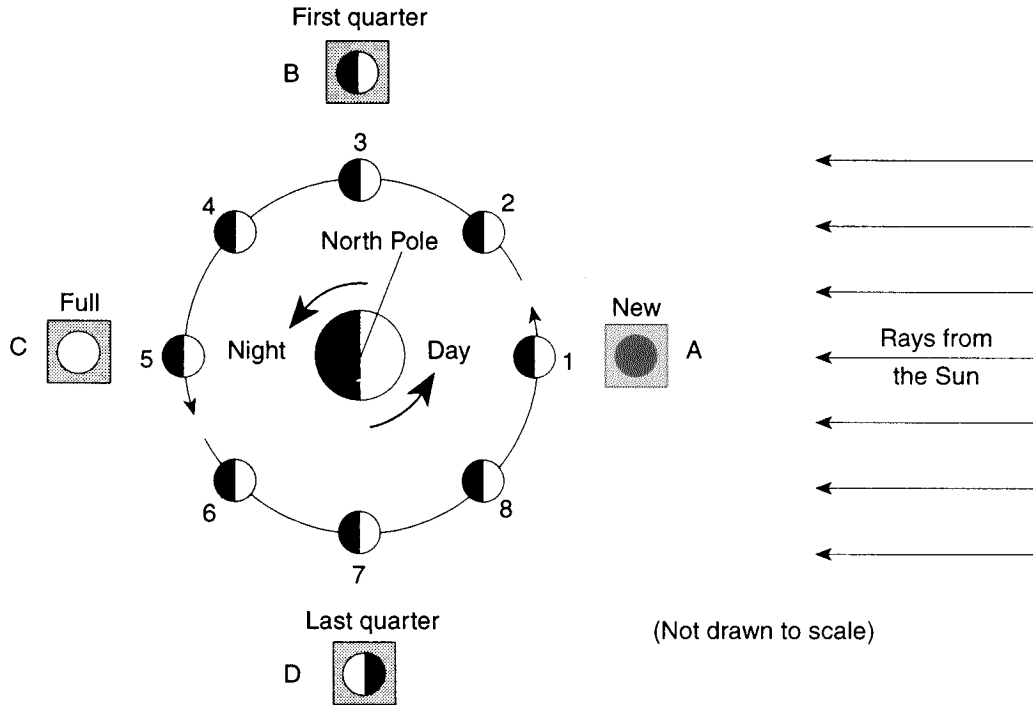


- 56 The greatest temperature variation from normal occurred during
- 1 May 1991
 - 2 August 1992
 - 3 July 1993
 - 4 March 1994
- 57 The addition of water vapor, carbon dioxide, and methane gas to the atmosphere changes Earth's climate. This change occurs primarily because these gases cause
- 1 cooler temperatures by absorbing infrared radiation
 - 2 cooler temperatures by absorbing ultraviolet radiation
 - 3 warmer temperatures by absorbing ultraviolet radiation
 - 4 warmer temperatures by absorbing infrared radiation
- 58 According to the graph, the longest time period that average Earth temperatures were warmer than normal was approximately
- (1) 8 months
 - (2) 14 months
 - (3) 26 months
 - (4) 30 months
- 59 Earth's average monthly temperature for October 1990 was approximately
- (1) 0.1 C° above normal
 - (2) 0.2 C° above normal
 - (3) 0.3 C° below normal
 - (4) 0.4 C° below normal
- 60 In late summer 1991, Mt. Pinatubo, a volcano in the Philippines, exploded and sent thousands of tons of volcanic dust into the atmosphere. Scientists have suggested that Earth's average monthly temperatures for many months after the explosion generally were
- 1 cooler than normal due to the reflection of sunlight by volcanic dust
 - 2 cooler than normal due to the formation of a hole in the ozone layer by the explosion
 - 3 warmer than normal due to the heat released into the atmosphere by the volcanic explosion
 - 4 warmer than normal due to the heat spread by convection of the volcanic dust

Group 2

If you choose this group, be sure to answer questions 61–65.

Base your answers to questions 61 through 65 on the *Earth Science Reference Tables*, the diagram below, and your knowledge of Earth science. The diagram represents a model of the Earth-Moon system as viewed from above the North Pole. The numbers 1 through 8 represent positions of the Moon as it revolves around Earth. The parts of the diagram lettered A through D show how the Moon's phases appear to an observer in New York State.



(Not drawn to scale)

61 The time required for the Moon to complete one cycle of phases is about one

- 1 day
- 2 week
- 3 month
- 4 year

62 As the Moon's phase changes from first quarter to last quarter, the visible portion of the Moon as observed from Earth will

- 1 decrease, only
- 2 increase, only
- 3 decrease, then increase
- 4 increase, then decrease

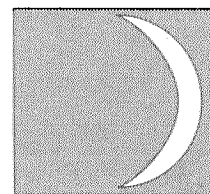
63 Which motion causes the Moon to show phases when viewed from Earth?

- 1 rotation of Earth
- 2 revolution of Earth
- 3 rotation of the Moon
- 4 revolution of the Moon

64 Which Moon phase appears highest in the sky at midnight to an observer on Earth?

- 1 full moon
- 2 new moon
- 3 first quarter
- 4 last quarter

65 An observer in New York State sees a crescent phase of the Moon, as shown below.



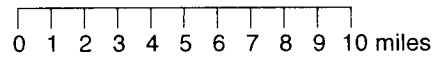
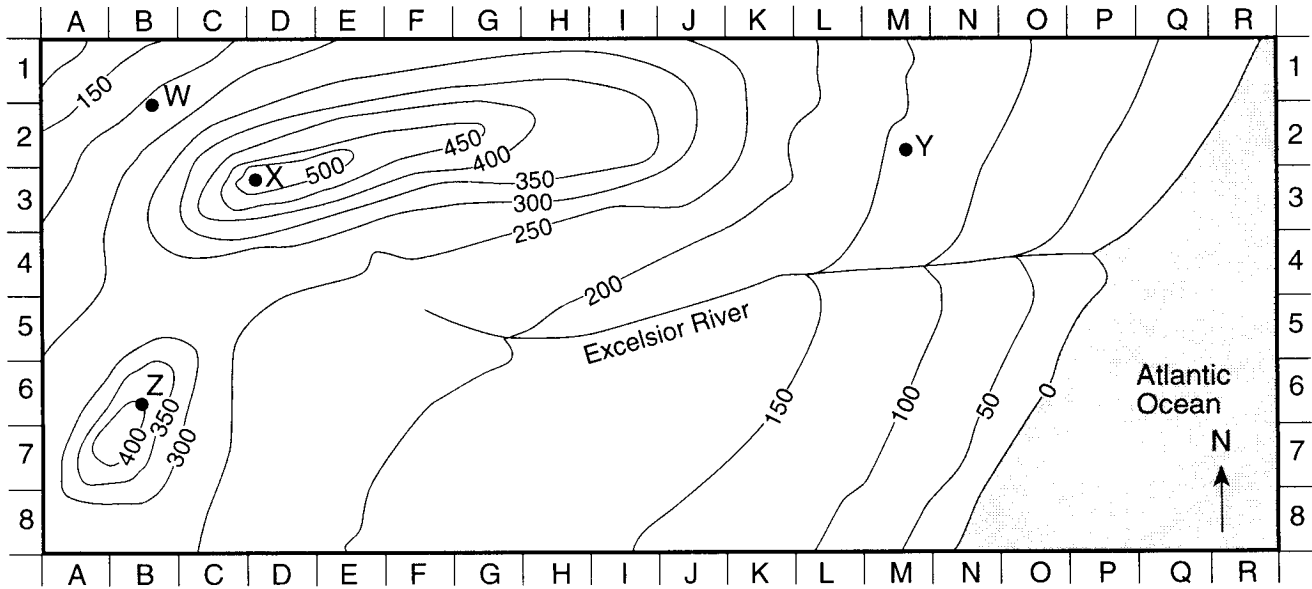
At which position is the Moon when this crescent phase is observed?

- 1 position 6
- 2 position 2
- 3 position 8
- 4 position 4

Group 3

If you choose this group, be sure to answer questions 66–70.

Base your answers to questions 66 through 70 on the *Earth Science Reference Tables*, the topographic map below that represents a location in North America, and your knowledge of Earth science. A grid system of letters and numbers along the edges of the map is provided to assist in finding locations. Elevations are expressed in feet.

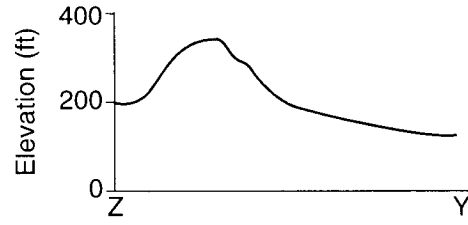


- | | |
|--|--|
| <p>66 What is the approximate elevation at grid location 7-I?</p> <p>(1) 140 ft (3) 200 ft
 (2) 170 ft (4) 230 ft</p> | <p>68 If a person at point W (grid location 2-B) travels uphill, in which direction is the person traveling?</p> <p>1 northwest 3 southwest
 2 northeast 4 southeast</p> |
| <p>67 What is a possible elevation at point X (grid location 3-D)?</p> <p>(1) 488 ft (3) 558 ft
 (2) 548 ft (4) 598 ft</p> | <p>69 What is the gradient of the entire length of the Excelsior River?</p> <p>(1) 0.1 ft/mi (3) 24 ft/mi
 (2) 11 ft/mi (4) 48 ft/mi</p> |

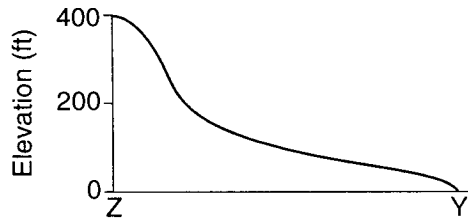
70 Which profile best represents the topography along a straight line from point Z (6-B) to point Y (2-M)?



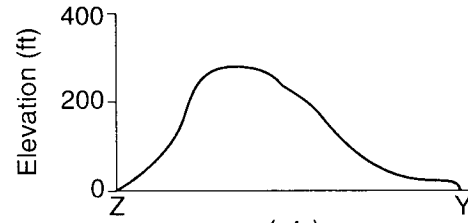
(1)



(3)



(2)



(4)

Group 4

If you choose this group, be sure to answer questions 71–75.

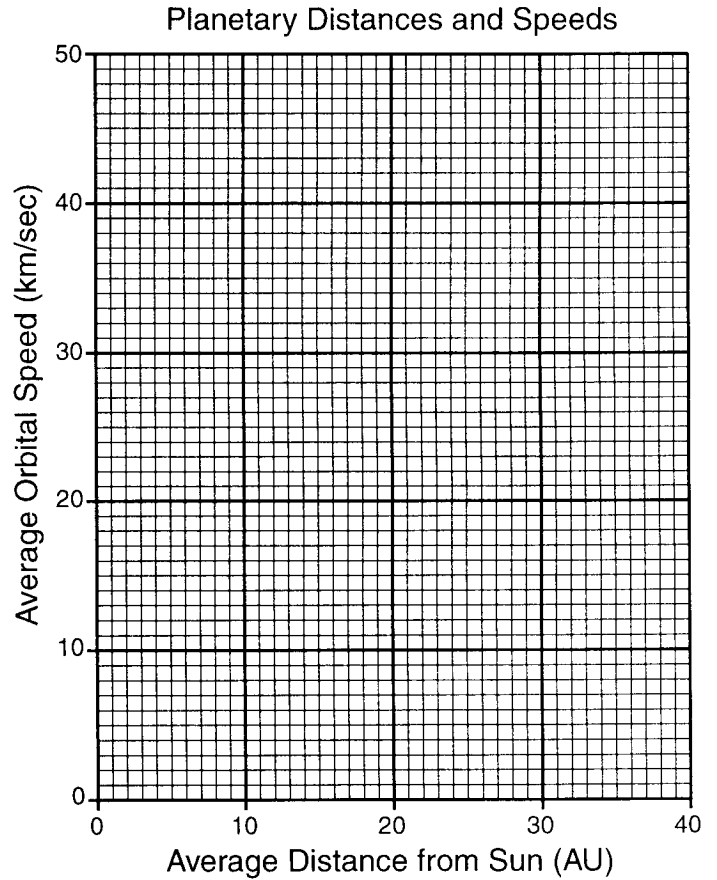
Base your answers to questions 71 through 75 on the *Earth Science Reference Tables*, the data tables below, and your knowledge of Earth science. Table 1 shows average planetary distance from the Sun in astronomical units (AU) and average orbital speed in kilometers per second (km/sec) for the nine planets in our solar system. Neptune’s average orbital speed has been deliberately left blank. Table 2 lists the five largest asteroids and their average distance from the Sun in astronomical units. A blank graph is provided for student use.

Table 1

Planet	Average Distance from Sun (AU)	Average Orbital Speed (km/sec)
Mercury	0.4	48.0
Venus	0.7	35.0
Earth	1.0	30.0
Mars	1.5	24.0
Jupiter	5.2	13.0
Saturn	9.6	10.0
Uranus	19.0	7.0
Neptune	30.0	
Pluto	39.0	4.7

Table 2

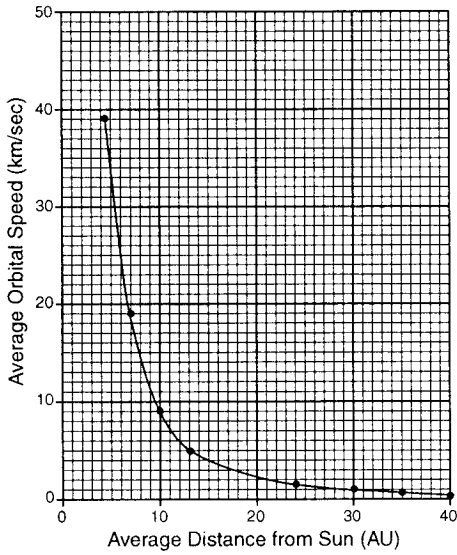
Asteroid	Average Distance from Sun (AU)
Vesta	2.4
Juno	2.7
Ceres	2.8
Pallas	2.8
Hygiea	3.2



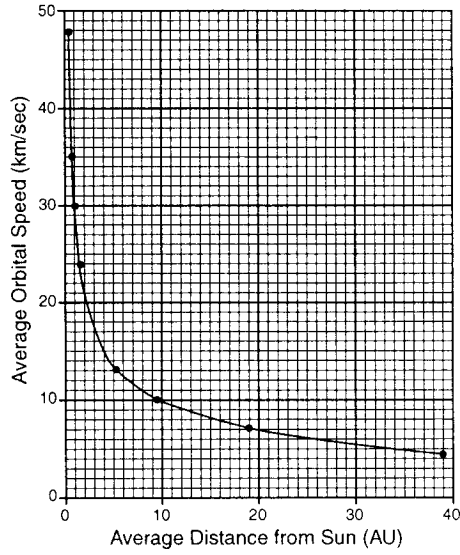
71 If the planets were all on the same side of the Sun, which line best shows the correct spacing between the inner planets and their distances from the Sun at a scale of 1 centimeter = 0.1 AU? [The Sun and planets are represented by points of identical sizes, but distances between them are drawn to scale.]

- (1) Sun Mercury Venus Earth Mars
- (2) Sun Mercury Venus Earth Mars
- (3) Sun Mercury Venus Earth Mars
- (4) Sun Mercury Venus Earth Mars

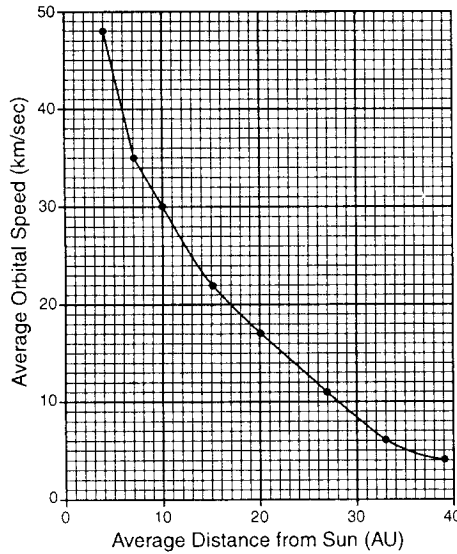
72 Which graph correctly shows the relationship between a planet's average distance from the Sun and the planet's average orbital speed?



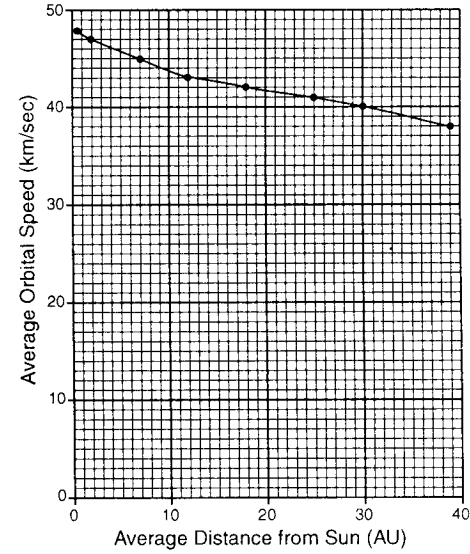
(1)



(3)



(2)



(4)

73 The average orbital speed of Neptune is approximately

- (1) 31.0 km/sec (3) 5.2 km/sec
 (2) 7.2 km/sec (4) 4.0 km/sec

74 The asteroids shown in table 2 are located between the orbits of

- 1 Mercury and Venus 3 Mars and Jupiter
 2 Earth and Mars 4 Neptune and Pluto

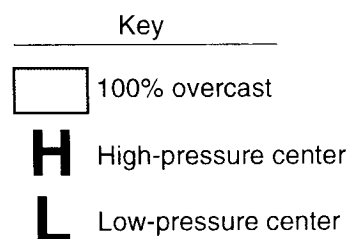
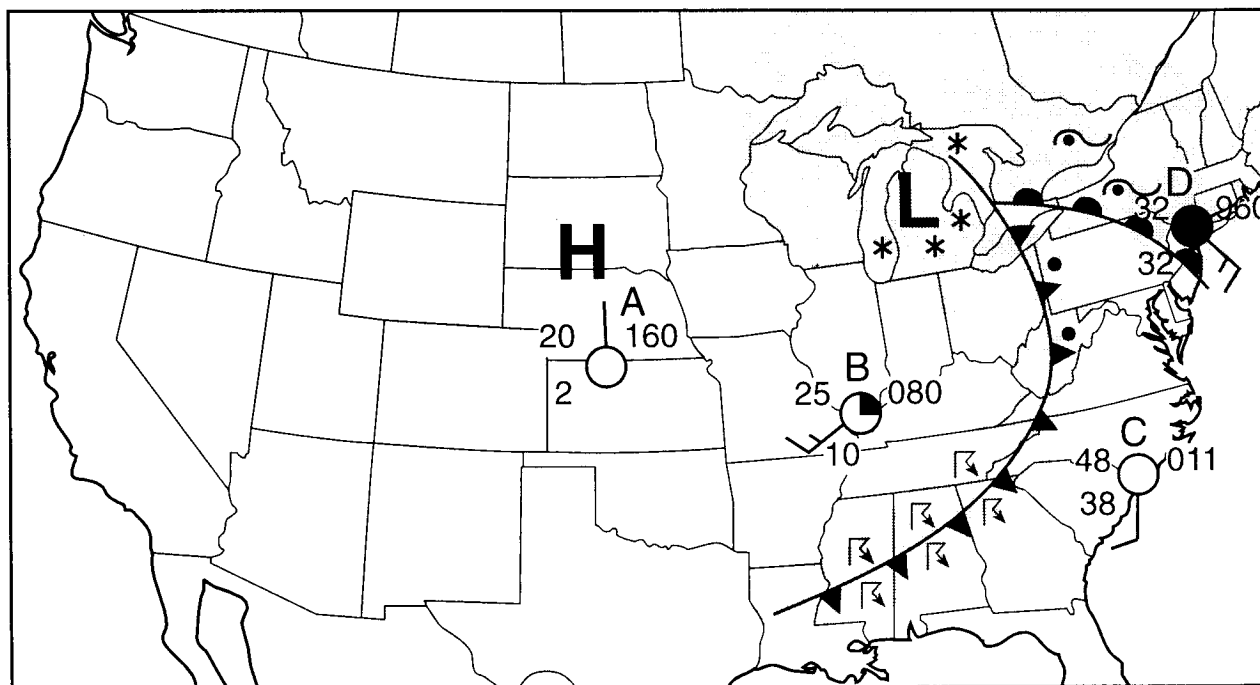
75 Based on its distance from the Sun, which asteroid probably has the greatest average orbital speed?

- 1 Vesta 3 Pallas
 2 Juno 4 Hygiea

Group 5

If you choose this group, be sure to answer questions 76–80.

Base your answers to questions 76 through 80 on the *Earth Science Reference Tables*, the weather map below, and your knowledge of Earth science. The weather map shows a storm system centered near the Great Lakes. Letters A through D represent weather stations shown on the map.



76 What weather conditions are shown at location D?

- 1 cloudy skies with light snow
- 2 cloudy skies with freezing rain
- 3 saturated air with no precipitation
- 4 partly cloudy skies with rain showers

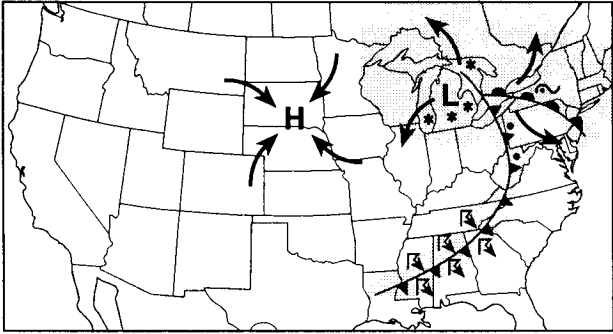
77 What type of weather front has entered New York State?

- 1 warm
- 2 cold
- 3 stationary
- 4 occluded

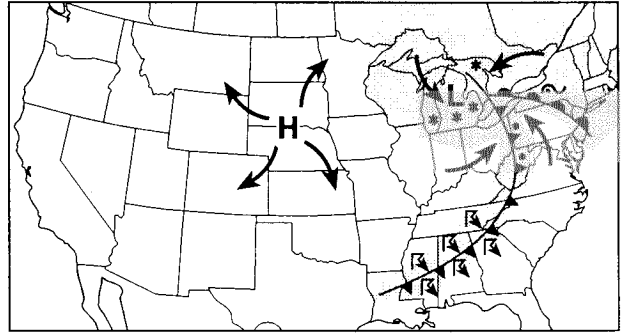
78 Which weather station is located in the mT air mass associated with this storm?

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

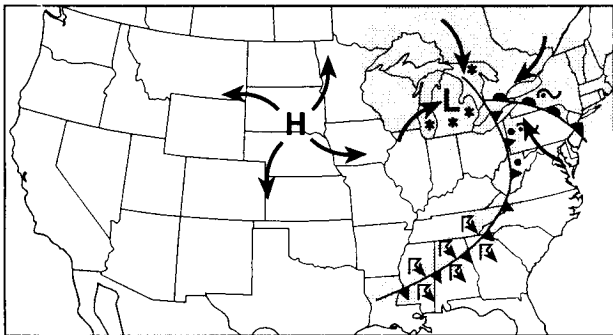
79 Which map best shows the surface winds associated with the high-pressure and the low-pressure center on the weather map?



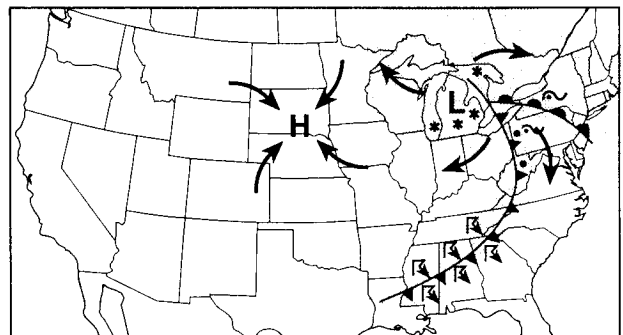
(1)



(3)

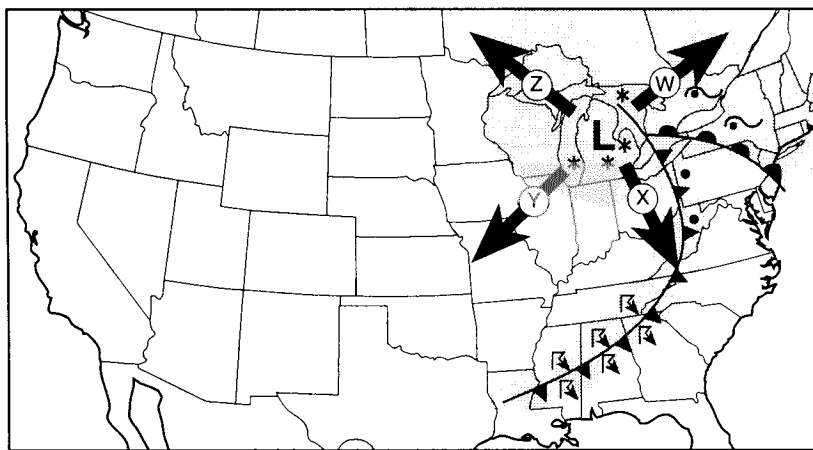


(2)



(4)

80 Letters W, X, Y, and Z on the map below represent possible directions of movement for this storm center.



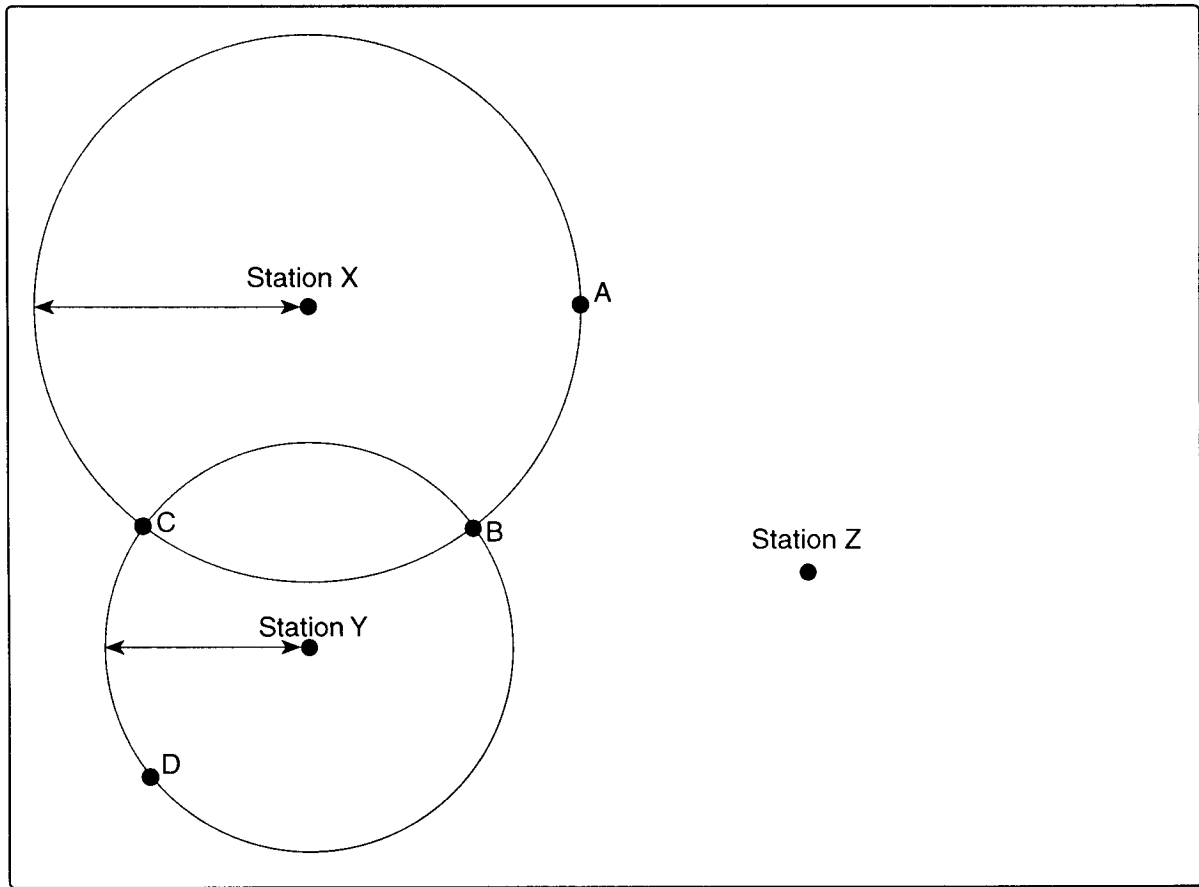
Which arrow best shows the direction this storm center will move if it follows a normal storm track?

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

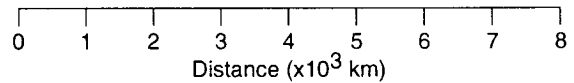
Group 6

If you choose this group, be sure to answer questions 81–85.

Base your answers to questions 81 through 85 on the *Earth Science Reference Tables*, the map below, and your knowledge of Earth science. The map shows seismic stations X, Y, and Z that have recorded seismic waves from the same earthquake. The distances from seismic stations X and Y to the earthquake epicenter have been drawn on the map. Locations A, B, C, and D represent possible earthquake epicenters. The distance from seismic station Z to the earthquake epicenter has been deliberately omitted.



(Drawn to scale)



81 How far is station X from the earthquake epicenter?

- (1) 5,200 km
- (2) 2,400 km
- (3) 3,000 km
- (4) 4,000 km

82 How long did the P-wave take to travel from the earthquake epicenter to station Y?

- (1) 2 min 10 sec
- (2) 3 min 40 sec
- (3) 4 min 0 sec
- (4) 5 min 40 sec

83 If the earthquake's focus was 2 kilometers below Earth's surface, the earthquake occurred in the

- 1 lithosphere
- 2 asthenosphere
- 3 stiffer mantle
- 4 outer core

84 Compared to the speed of *S*-waves in a given Earth material, the speed of *P*-waves is

- 1 always slower
- 2 always faster
- 3 always identical
- 4 sometimes slower and sometimes faster

85 Station *Z* recorded a time difference of 6 minutes 40 seconds between the arrival of the *P*-waves and the arrival of the *S*-waves. The earthquake epicenter was located closest to location

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

Group 7

If you choose this group, be sure to answer questions 86–90.

Base your answers to questions 86 through 90 on the water budget data and climate classification below and on your knowledge of Earth science. Table 1 shows water budget data for a location in New York State, and table 2 describes climate types. All data are expressed in millimeters of water.

Table 1

Water Budget Data

Month	J	F	M	A	M	J	J	A	S	O	N	D	Yearly Total
Precipitation (P)	72	68	81	75	74	87	84	82	72	76	63	72	906
Potential Evapotranspiration (E_p)	0	0	3	34	83	115	134	122	84	46	15	0	636
Storage (S_t)	100	100	100	100	91	63	13	0	0	30	78	100	—

Table 2

Climate Classification

Climate Type	Total Yearly P/E_p Ratio
Humid	greater than 1.2
Subhumid	0.8 to 1.2
Semiarid	0.4 to 0.8
Arid	less than 0.4

86 What is the total amount of moisture added to soil storage during October?

- (1) 0 mm
- (2) 30 mm
- (3) 46 mm
- (4) 76 mm

87 Surplus soil moisture exists during the month of

- 1 May
- 2 October
- 3 November
- 4 December

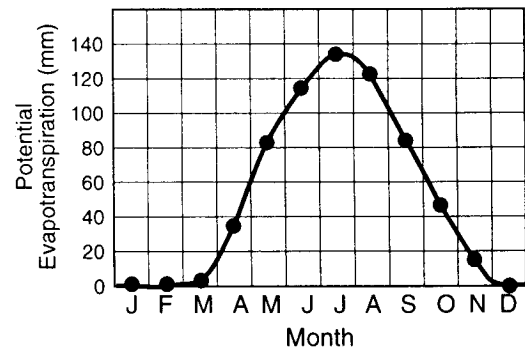
88 Stream discharge at this location would probably be lowest during

- 1 April
- 2 May
- 3 August
- 4 November

89 According to the information provided in table 2, the area represented by the water budget data would have a climate classified as

- 1 humid
- 2 subhumid
- 3 semiarid
- 4 arid

90 The graph below shows the monthly potential evapotranspiration for this location.



Which factor is mainly responsible for the pattern of potential evapotranspiration illustrated by the graph?

- 1 average air temperature
- 2 actual evapotranspiration
- 3 amount of recharge
- 4 amount of soil moisture in storage

Group 8

If you choose this group, be sure to answer questions 91–95.

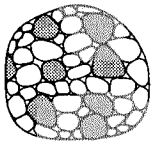
Base your answers to questions 91 through 95 on the *Earth Science Reference Tables*, the table below, and your knowledge of Earth science. The table provides information about the crystal sizes and the mineral compositions of four igneous rocks, A, B, C, and D.

Mineral	Coarse Grained		Fine Grained	
	Rock A	Rock B	Rock C	Rock D
Quartz	40	0	0	0
Pyroxene	0	25	0	70
Plagioclase feldspar	20	0	60	10
Potassium feldspar	20	0	0	0
Biotite	10	0	17	0
Hornblende	10	0	23	3
Olivine	0	75	0	17

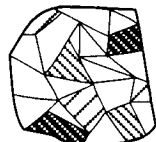
91 Which characteristic of rock B could be caused by the minerals pyroxene and olivine?

- 1 green color
- 2 felsic composition
- 3 folded layers
- 4 metallic luster

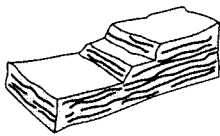
92 Which diagram best represents the texture, composition, and intergrown crystals of rock A?



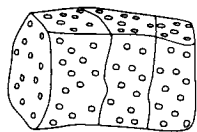
(1)



(3)



(2)



(4)

93 Rock B most likely is

- 1 conglomerate
- 2 schist
- 3 obsidian
- 4 peridotite

94 The mineral quartz in rock A is composed of the two most abundant elements by mass in Earth's crust. These two elements are oxygen and

- 1 magnesium
- 2 silicon
- 3 iron
- 4 lead

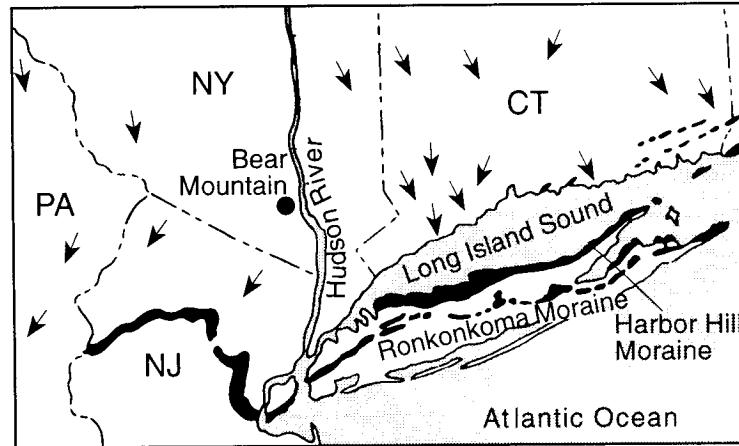
95 Which two rocks most likely formed farthest below the surface of Earth?

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

Group 9

If you choose this group, be sure to answer questions 96–100.

Base your answers to questions 96 through 100 on the *Earth Science Reference Tables*, the map below, and your knowledge of Earth science. The arrows on the map show the location and orientation of glacial striations on the surface bedrock. Dark shading shows the location of large moraines (glacial deposits).



- 96 The striations indicate that the movement of glacial ice was toward the
- 1 northeast and northwest
 - 2 northeast and southwest
 - 3 southeast and northwest
 - 4 southeast and southwest
- 97 How were the striations made?
- 1 Frost action cracked the bedrock during the ice age.
 - 2 Rocks at the bottom of the glaciers were dragged over the bedrock.
 - 3 Particles carried by winds scratched the bedrock during the ice age.
 - 4 Particles carried by glacial meltwater eroded the bedrock.
- 98 The moraines are recognized as glacial deposits because they are composed of rock materials that are
- 1 uniform in size and layered
 - 2 uniform in size and not layered
 - 3 many different sizes and layered
 - 4 many different sizes and not layered
- 99 The Harbor Hill Moraine and the Ronkonkoma Moraine are believed to have formed during the
- 1 Jurassic Period
 - 2 Cambrian Period
 - 3 Pleistocene Epoch
 - 4 Pennsylvanian Epoch
- 100 Observations of which feature would be most useful in determining the thickness of the ice sheet?
- 1 grooved bedrock near the top of Bear Mountain
 - 2 glacial soils in southern Connecticut
 - 3 glacial boulders at the bottom of Long Island Sound
 - 4 scratches on loose rock at the mouth of the Hudson River

Group 10

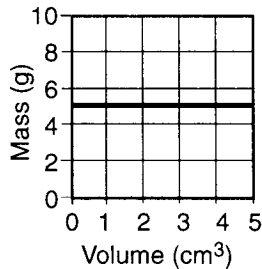
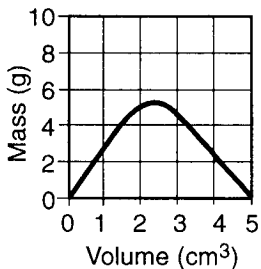
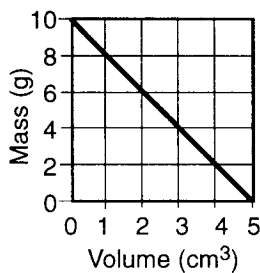
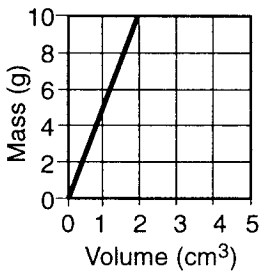
If you choose this group, be sure to answer questions 101–105.

Base your answers to questions 101 through 105 on the *Earth Science Reference Tables* and on your knowledge of Earth science.

101 A person incorrectly measures the mass of a rock as 346 grams. The actual mass is 326 grams. What is the person's approximate percent deviation (percentage of error)?

- (1) 5.8%
- (2) 6.1%
- (3) 8.2%
- (4) 16.3%

102 Which graph best represents the relationship between mass and volume of a material that has a density of 5 grams per cubic centimeter?



103 What is the total number of calories of latent heat that must be absorbed by 1,000 grams of ice at 0°C to change all of the ice to liquid water at 0°C?

- (1) 1,000 cal
- (2) 10,000 cal
- (3) 80,000 cal
- (4) 540,000 cal

104 The pressure at the interface between the mantle and the outer core of Earth is inferred to be approximately

- (1) 1.0 million atmospheres
- (2) 1.4 million atmospheres
- (3) 3.0 million atmospheres
- (4) 3.4 million atmospheres

105 The largest meteorite impact crater in North America formed approximately 1,850 million years ago, which was during the

- 1 Middle Archean Era
- 2 Early Proterozoic Era
- 3 Early Jurassic Period
- 4 Late Cretaceous Period

Part II (35 credits)

Answer the questions in only seven of the ten groups in this part. Be sure to mark the answers to the groups of questions you choose in accordance with the instructions on the front cover of the test booklet. Leave blank the three groups of questions you do not choose to answer.

Group 1				
56	1	2	3	4
57	1	2	3	4
58	1	2	3	4
59	1	2	3	4
60	1	2	3	4

Group 2				
61	1	2	3	4
62	1	2	3	4
63	1	2	3	4
64	1	2	3	4
65	1	2	3	4

Group 3				
66	1	2	3	4
67	1	2	3	4
68	1	2	3	4
69	1	2	3	4
70	1	2	3	4

Group 4				
71	1	2	3	4
72	1	2	3	4
73	1	2	3	4
74	1	2	3	4
75	1	2	3	4

Group 5				
76	1	2	3	4
77	1	2	3	4
78	1	2	3	4
79	1	2	3	4
80	1	2	3	4

Group 6				
81	1	2	3	4
82	1	2	3	4
83	1	2	3	4
84	1	2	3	4
85	1	2	3	4

Group 7				
86	1	2	3	4
87	1	2	3	4
88	1	2	3	4
89	1	2	3	4
90	1	2	3	4

Group 8				
91	1	2	3	4
92	1	2	3	4
93	1	2	3	4
94	1	2	3	4
95	1	2	3	4

Group 9				
96	1	2	3	4
97	1	2	3	4
98	1	2	3	4
99	1	2	3	4
100	1	2	3	4

Group 10				
101	1	2	3	4
102	1	2	3	4
103	1	2	3	4
104	1	2	3	4
105	1	2	3	4

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

Signature

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

EARTH SCIENCE

Thursday, August 12, 1999 —12:30 to 3:30 p.m., only

ANSWER SHEET

Part I Credits
Part II Credits
Performance Test Credits.	<u> </u>
Total (Official Regents)	
Examination Mark
Reviewer's Initials: _____	

Student Sex: Male Female

Teacher School

Grade (circle one) 8 9 10 11 12

Record all of your answers on this answer sheet in accordance with the instructions on the front cover of the test booklet.

Part I (55 credits)

- | | | | |
|-------------------|-------------------|-------------------|-------------------|
| 1 1 2 3 4 | 16 1 2 3 4 | 31 1 2 3 4 | 46 1 2 3 4 |
| 2 1 2 3 4 | 17 1 2 3 4 | 32 1 2 3 4 | 47 1 2 3 4 |
| 3 1 2 3 4 | 18 1 2 3 4 | 33 1 2 3 4 | 48 1 2 3 4 |
| 4 1 2 3 4 | 19 1 2 3 4 | 34 1 2 3 4 | 49 1 2 3 4 |
| 5 1 2 3 4 | 20 1 2 3 4 | 35 1 2 3 4 | 50 1 2 3 4 |
| 6 1 2 3 4 | 21 1 2 3 4 | 36 1 2 3 4 | 51 1 2 3 4 |
| 7 1 2 3 4 | 22 1 2 3 4 | 37 1 2 3 4 | 52 1 2 3 4 |
| 8 1 2 3 4 | 23 1 2 3 4 | 38 1 2 3 4 | 53 1 2 3 4 |
| 9 1 2 3 4 | 24 1 2 3 4 | 39 1 2 3 4 | 54 1 2 3 4 |
| 10 1 2 3 4 | 25 1 2 3 4 | 40 1 2 3 4 | 55 1 2 3 4 |
| 11 1 2 3 4 | 26 1 2 3 4 | 41 1 2 3 4 | |
| 12 1 2 3 4 | 27 1 2 3 4 | 42 1 2 3 4 | |
| 13 1 2 3 4 | 28 1 2 3 4 | 43 1 2 3 4 | |
| 14 1 2 3 4 | 29 1 2 3 4 | 44 1 2 3 4 | |
| 15 1 2 3 4 | 30 1 2 3 4 | 45 1 2 3 4 | |

Record your answers for Part II on the back of this sheet.