

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

PHYSICAL SETTING
EARTH SCIENCE

Thursday, August 16, 2001 — 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 *Earth Science Reference Tables*. The *Earth Science Reference Tables* are supplied separately. Be certain you have a copy of the *2001 edition* 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.

Your answer booklet for Part B–2 and Part C is stapled in the center of this examination booklet. Open the examination booklet, carefully remove your answer booklet, and close the examination booklet. Then fill in the heading 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 answer sheet and 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.

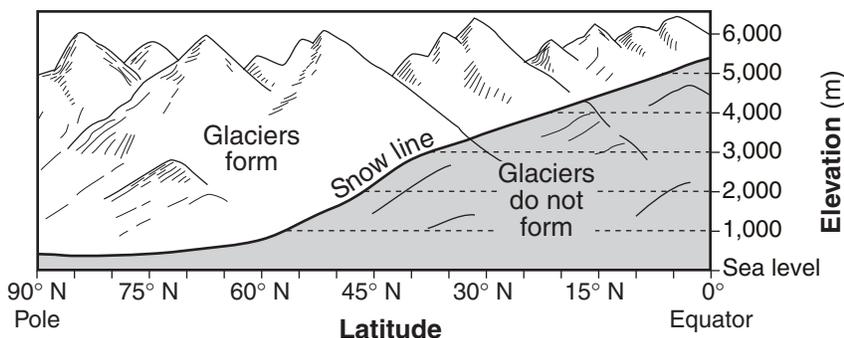
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

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*.

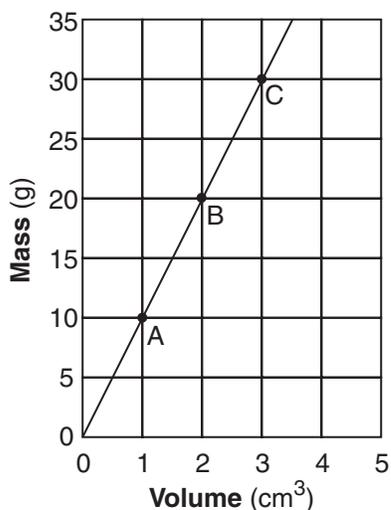
- 1 The graph below shows the snow line (the elevation above which glaciers form at different latitudes in the Northern Hemisphere).



At which location would a glacier most likely form?

- (1) 0° latitude at an elevation of 6,000 m
- (2) 15° N latitude at an elevation of 4,000 m
- (3) 30° N latitude at an elevation of 3,000 m
- (4) 45° N latitude at an elevation of 1,000 m

- 2 The graph below shows the relationship between mass and volume for three samples, A, B, and C, of a given material.



What is the density of this material?

- (1) 1.0 g/cm³
- (2) 5.0 g/cm³
- (3) 10.0 g/cm³
- (4) 20.0 g/cm³

- 3 The length of an Earth day is determined by the time required for approximately one

- (1) Earth rotation
- (2) Earth revolution
- (3) Sun rotation
- (4) Sun revolution

- 4 To an observer in Buffalo, New York, the North Star, *Polaris*, is always located above the northern horizon at an altitude of approximately

- (1) 23½°
- (2) 43°
- (3) 66½°
- (4) 90°

- 5 Which planet is approximately thirty times farther from the Sun than Earth is?

- (1) Jupiter
- (2) Saturn
- (3) Uranus
- (4) Neptune

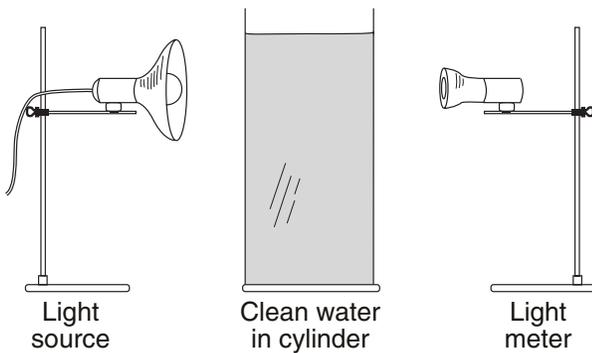
6 Which object is located at one foci of the elliptical orbit of Mars?

- (1) the Sun (3) Earth
 (2) *Betelgeuse* (4) Jupiter

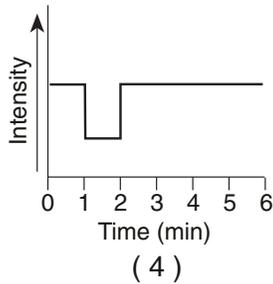
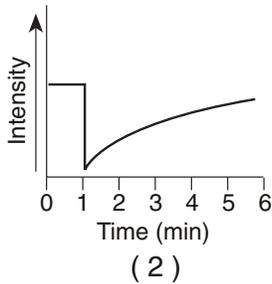
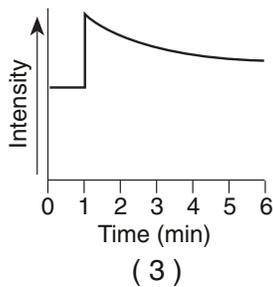
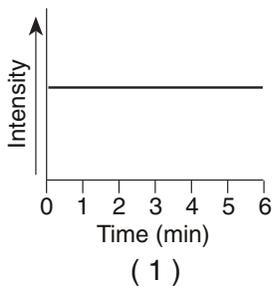
7 What is the basic difference between ultraviolet, visible, and infrared radiation?

- (1) half-life (3) wavelength
 (2) temperature (4) wave velocity

8 The diagram below shows a cylinder filled with clean water. At the left of the cylinder is a light source, and at the right of the cylinder is a meter that measures the intensity (brightness) of light as it passes through the water. One minute after the light is turned on, a mixture of sand, silt, and clay is poured into the cylinder.



Which graph shows the probable change in light intensity (brightness) recorded during the 6-minute period after the light is turned on?



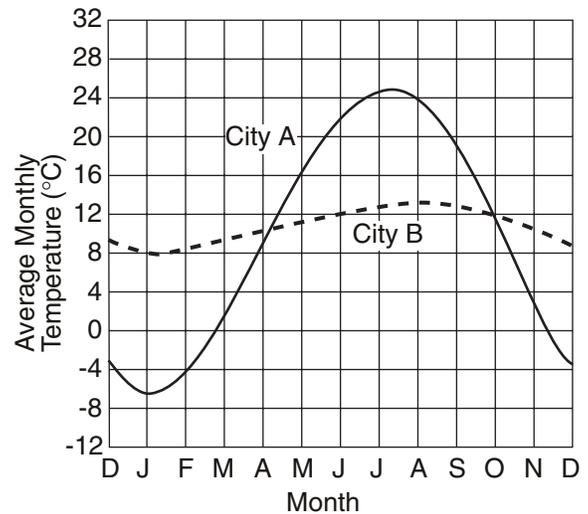
9 What is the dewpoint when the dry-bulb temperature is 24°C and the wet-bulb temperature is 15°C?

- (1) 8°C (3) 36°C
 (2) -18°C (4) 4°C

10 In New York State, dry, cool air masses (cP) often interact with moist, warm air masses (mT). Which statement correctly matches each air mass with its usual geographic source region?

- (1) cP is from the North Atlantic Ocean and mT is from the deserts of the southwestern United States.
 (2) cP is from northern Canada and mT is from the deserts of the southwestern United States.
 (3) cP is from northern Canada and mT is from the Gulf of Mexico.
 (4) cP is from the North Atlantic Ocean and mT is from the Gulf of Mexico.

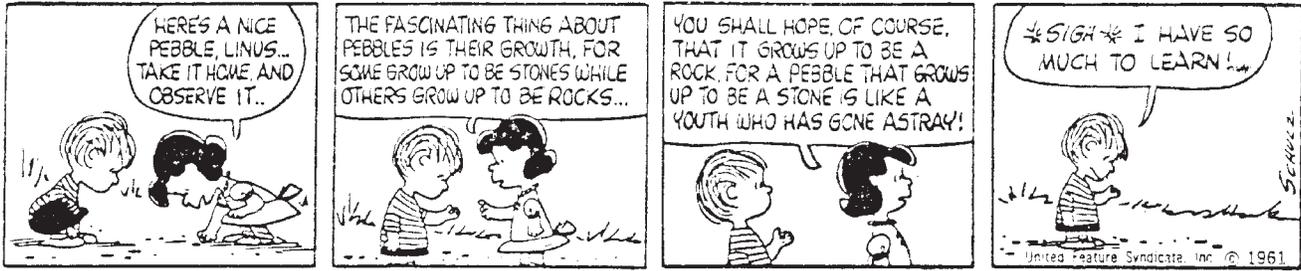
11 The graph below shows the average monthly temperatures for two cities, A and B, which are both located at 41° north latitude.



Which statement best explains the difference in the average yearly temperature range for the two cities?

- (1) City B is located in a different planetary wind belt.
 (2) City B receives less yearly precipitation.
 (3) City B has a greater yearly duration of insolation.
 (4) City B is located near a large body of water.

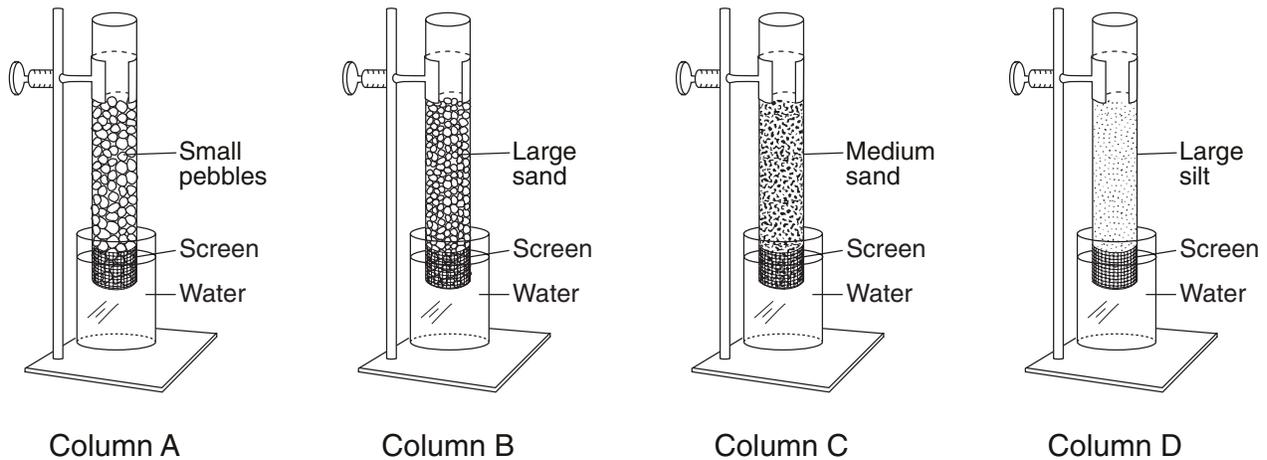
12 In the cartoon below, Lucy gives Linus incorrect information about pebbles.



If Lucy wanted to give Linus correct information about pebbles, which statement would be most accurate?

- (1) Pebbles can become cemented together to form a rock called gabbro.
- (2) Pebble is the name given to the smallest-size sediment.
- (3) Any large rock that weathers could become a pebble.
- (4) Magma is composed of pebbles.

Base your answers to questions 13 through 15 on the diagram below. Columns A, B, C, and D are partially filled with different sediments. Within each column, the sediment is uniform in size. A fine wire mesh screen covers the bottom of each column to prevent the sediment from falling out. The lower part of each column has just been placed in a beaker of water. Sediment sizes are not drawn to scale.



13 Which column contains sediment with an average diameter closest to 0.1 centimeter?

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

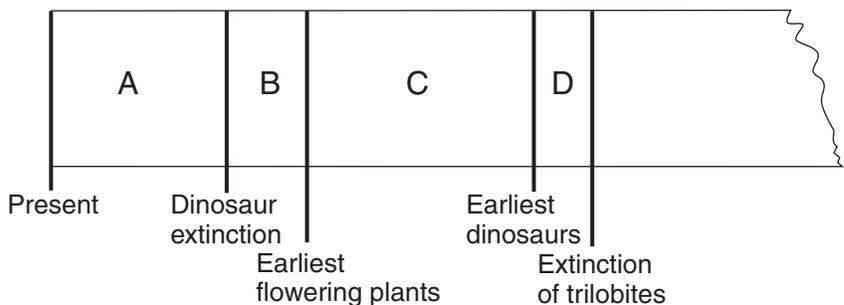
14 In which sediment will capillary action cause the water from the beaker to rise fastest in the column?

- (1) small pebbles
- (2) large sand
- (3) medium sand
- (4) large silt

15 In an experiment, the beakers of water were removed and replaced with empty beakers. The sediments were allowed to dry. Then water was poured into each column to compare the permeability of the sediments. The permeability rate of the medium sand sample was shown to be

- (1) less than the silt and pebble samples
- (2) less than the silt sample but more than the pebble sample
- (3) greater than the silt sample but less than the pebble sample
- (4) greater than the silt and pebble samples

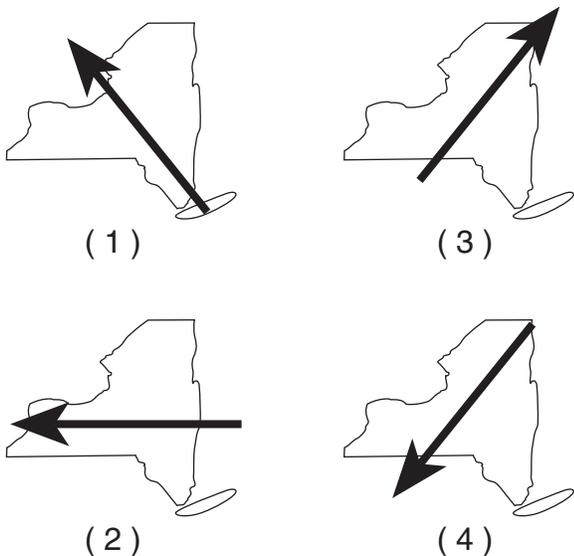
23 The diagram below is a portion of a geologic time line. Letters A through D represent the time intervals between the labeled events, as estimated by some scientists.



Fossil evidence indicates that the earliest birds developed during which time interval?

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

24 In which map does the arrow show the general direction that most low-pressure storm systems move across New York State?



25 The apparent daily path of the Sun changes with the seasons because

- (1) Earth's axis is tilted
- (2) Earth's distance from the Sun changes
- (3) the Sun revolves
- (4) the Sun rotates

26 In general, the probability of flooding decreases when there is an increase in the amount of

- (1) precipitation
- (2) infiltration
- (3) runoff
- (4) snow melt

27 Which object orbits Earth in both the Earth-centered (geocentric) and Sun-centered (heliocentric) models of our solar system?

- (1) the Moon
- (2) Venus
- (3) the Sun
- (4) Polaris

28 Predictable changes in the direction of swing of a Foucault pendulum provide evidence that

- (1) Earth is tilted on its axis
- (2) Earth rotates on its axis
- (3) Earth's orbit is slightly elliptical
- (4) Earth's magnetic poles reverse over time

29 Compared to felsic igneous rocks, mafic igneous rocks contain greater amounts of

- (1) white quartz
- (2) aluminum
- (3) pink feldspar
- (4) iron

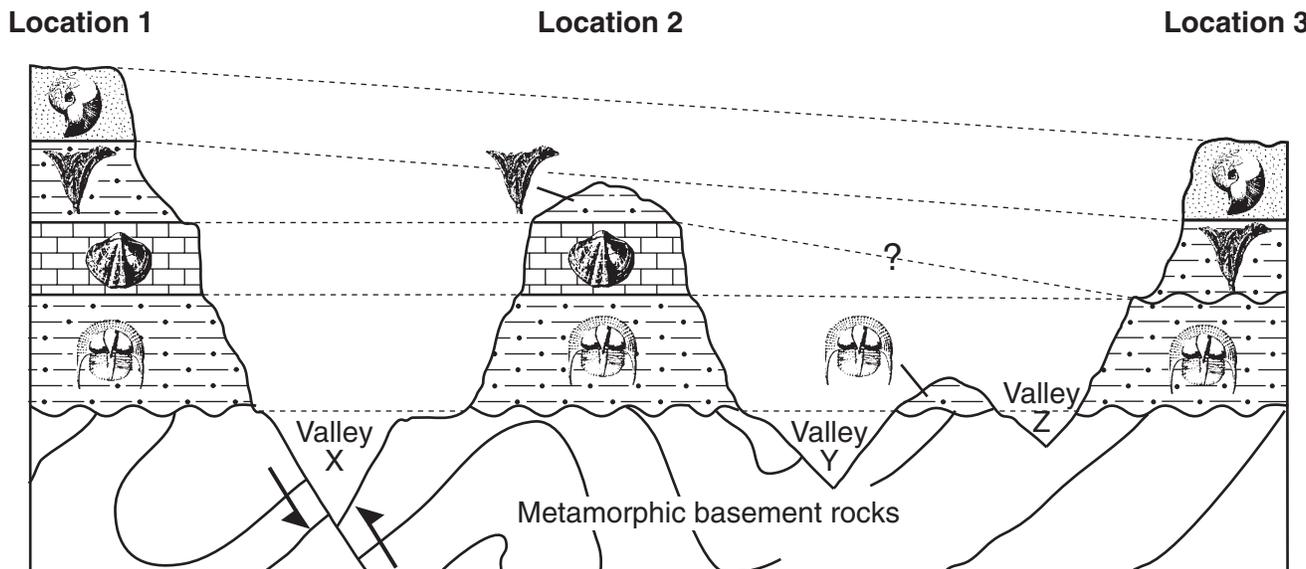
30 What is the age of the most abundant surface bedrock in the Finger Lakes region of New York State?

- (1) Cambrian
- (2) Devonian
- (3) Pennsylvanian
- (4) Permian

31 What are the two most abundant elements by mass found in Earth's crust?

- (1) aluminum and iron
- (2) sodium and chlorine
- (3) calcium and carbon
- (4) oxygen and silicon

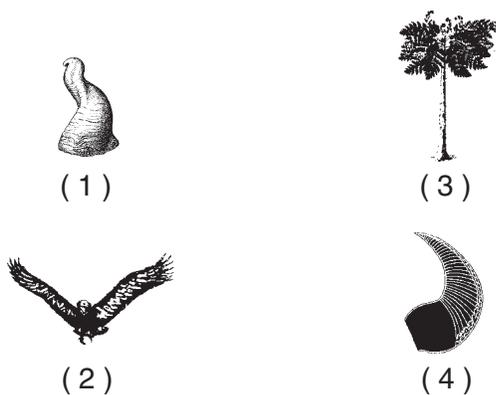
Base your answers to questions 32 through 35 on the geologic cross section below, which shows a view of rock layers at Earth's surface. The dashed lines connect points of the same age. Major fossils contained within each rock layer are shown. The valleys are labeled X, Y, and Z.



32 In which type of environment were the sediments that formed these sedimentary rock layers most likely deposited?

- (1) glacial
- (2) mountainous
- (3) marine
- (4) terrestrial plateau

33 Which fossil would most likely be found in the same siltstone layer as the *Cryptolithus* fossil?



34 The sedimentary rock layers at the three locations can be most accurately correlated by comparing the

- (1) thickness of the sedimentary rock layers
- (2) foliation bands in the metamorphic basement rocks
- (3) fossils in the sedimentary rocks
- (4) minerals in the igneous rocks

35 In this region, valley X is more deeply eroded than either valley Y or valley Z. The most likely explanation for this occurrence is that the metamorphic rock near X has been

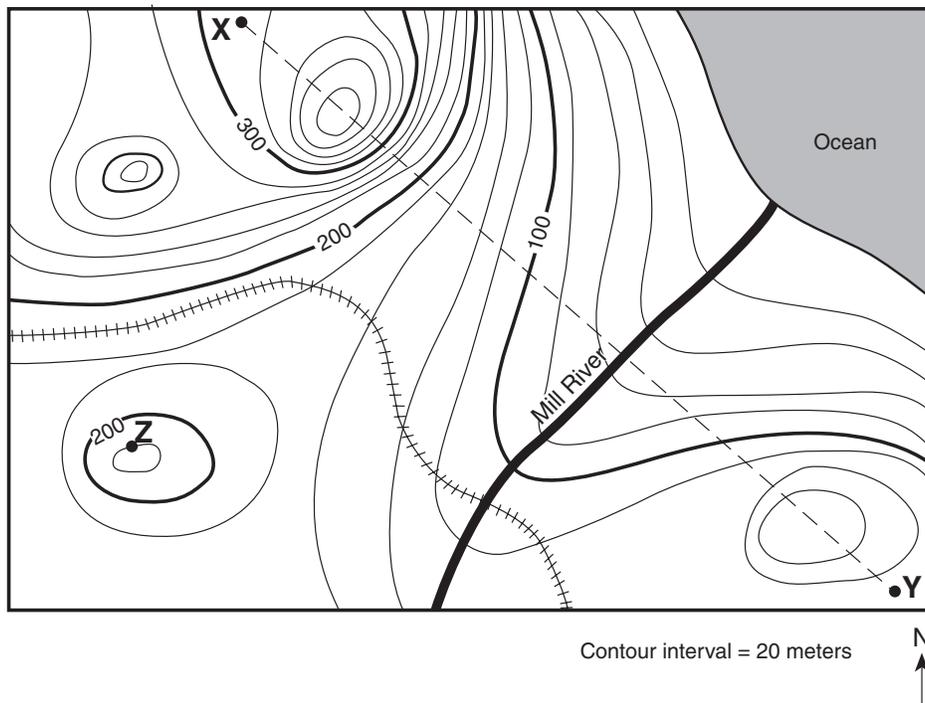
- (1) weakened by faulting
- (2) folded by pressure
- (3) intruded by melted rock
- (4) covered by sedimentary rocks

Part B-1

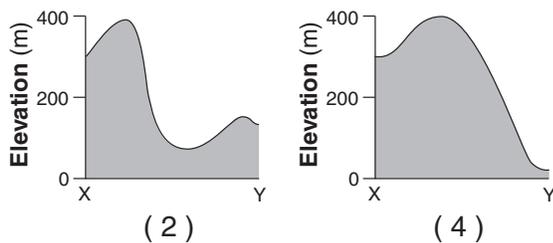
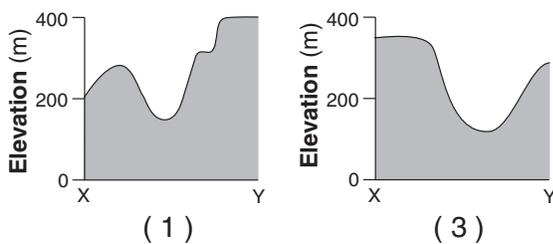
Answer all questions in this part.

Directions (36–52): 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 topographic map below. Points X, Y, and Z are locations on the map. Elevations are expressed in meters.



36 Which profile best represents the topography along the dashed line from point X to point Y?



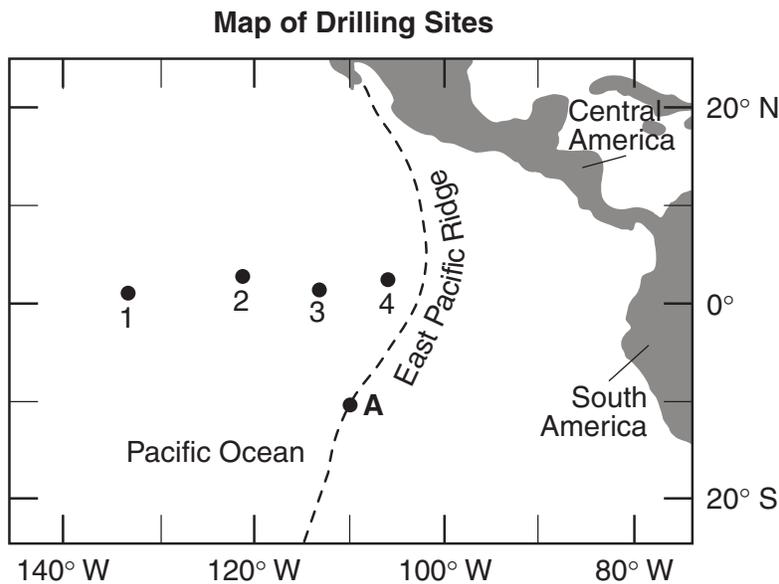
37 Mill River generally flows toward the

- (1) southeast
- (2) southwest
- (3) northeast
- (4) northwest

38 What is the elevation of point Z?

- (1) 190 m
- (2) 220 m
- (3) 240 m
- (4) 250 m

Base your answers to questions 39 through 41 on the map below. The map shows the locations of deep-sea core drilling sites numbered 1 through 4. The approximate location of the East Pacific Ridge is shown by a dashed line. Point A is located on the East Pacific Ridge.



39 At point A, the East Pacific Ridge is the boundary between the

- (1) Cocos Plate and the North American Plate
- (2) South American Plate and the Nazca Plate
- (3) Pacific Plate and the South American Plate
- (4) Pacific Plate and the Nazca Plate

40 At which drilling site would the oldest igneous bedrock most likely be found?

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

41 Compared to the thickness and density of the continental crust of South America, the oceanic crust of the Pacific floor is

- (1) thinner and less dense
- (2) thinner and more dense
- (3) thicker and less dense
- (4) thicker and more dense

Base your answers to questions 42 and 43 on the map below. Seismic stations are located at the four cities shown on the map. Letter X represents the epicenter of an earthquake determined from seismic waves recorded at all four cities.



- 42 At which city is there a difference of approximately 3 minutes and 20 seconds between the arrival times of the *P*-waves and the *S*-waves?
- | | |
|-----------------|-------------------|
| (1) New Orleans | (3) Pittsburgh |
| (2) Louisville | (4) New York City |

43 Which map correctly shows how the location of the epicenter was determined?



(1)



(3)

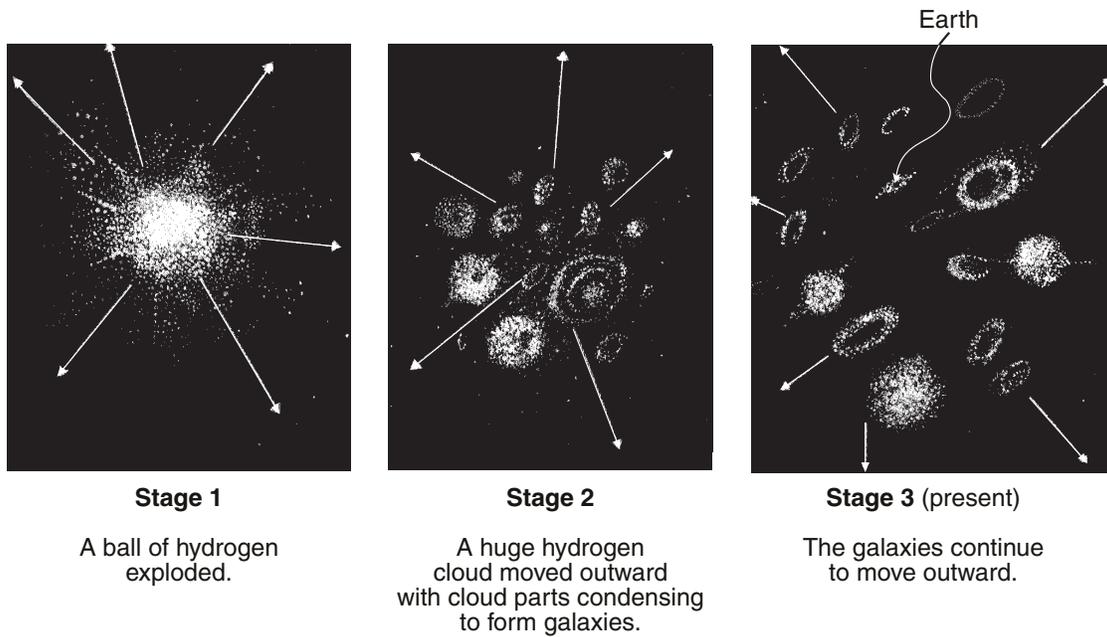


(2)



(4)

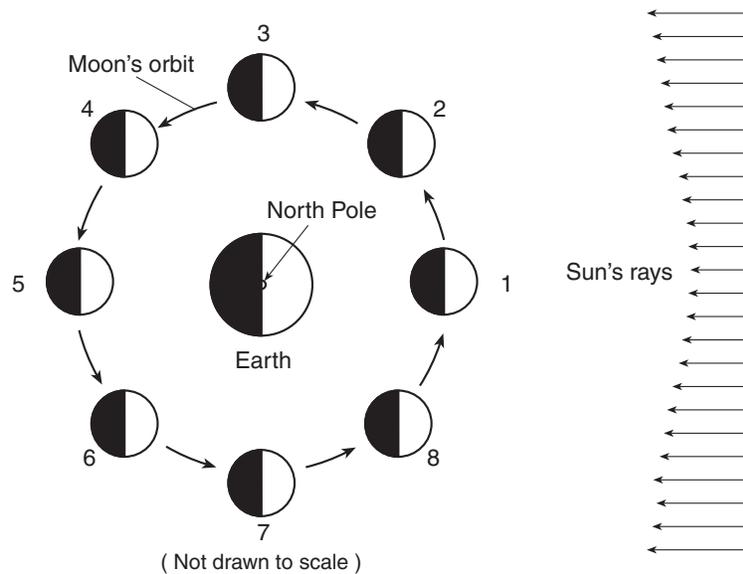
44 The diagram below illustrates three stages of a current theory of the formation of the universe.



A major piece of scientific evidence supporting this theory is the fact that wavelengths of light from galaxies moving away from Earth in stage 3 are observed to be

- | | |
|--|---------------------------------------|
| (1) shorter than normal (a red shift) | (3) longer than normal (a red shift) |
| (2) shorter than normal (a blue shift) | (4) longer than normal (a blue shift) |

45 The diagram below shows the Moon orbiting Earth as viewed from space above the North Pole. The Moon is shown at eight different positions in its orbit.

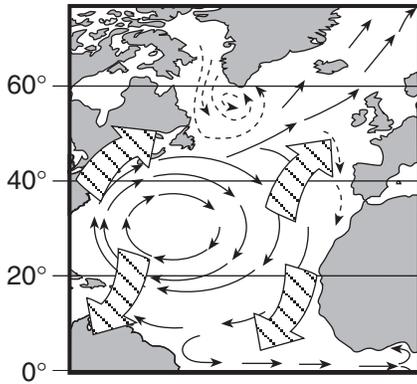
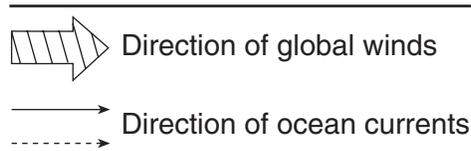


At which two positions of the Moon is an eclipse of the Sun or Moon possible?

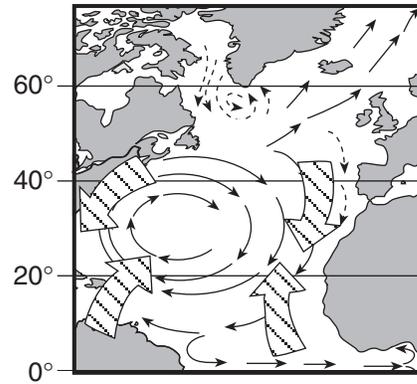
- | | |
|-------------|-------------|
| (1) 1 and 5 | (3) 3 and 7 |
| (2) 2 and 6 | (4) 4 and 8 |

46 Which map best represents the global prevailing surface wind patterns responsible for generating Atlantic Ocean currents?

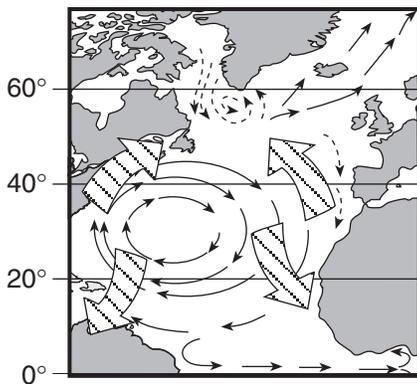
Key



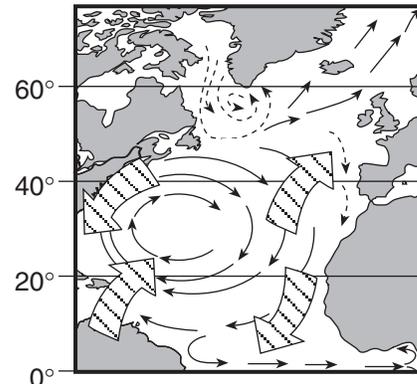
(1)



(3)

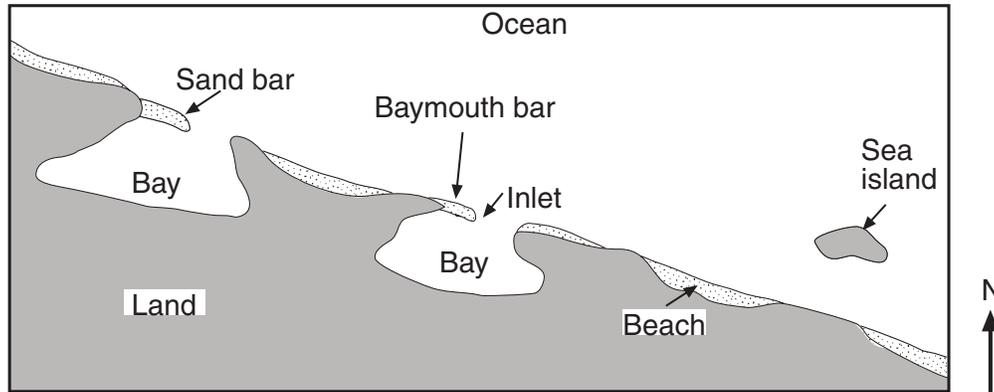


(2)



(4)

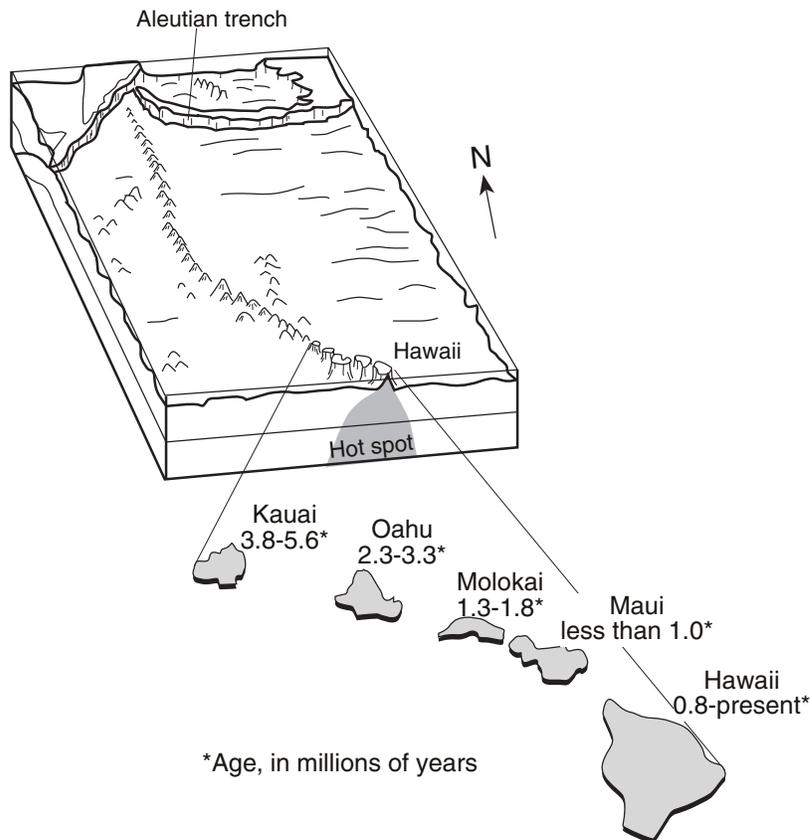
47 The map below shows some features along an ocean shoreline.



In which general direction is the sand being moved along this shoreline by ocean (long-shore) currents?

- (1) northeast
- (2) southeast
- (3) northwest
- (4) southwest

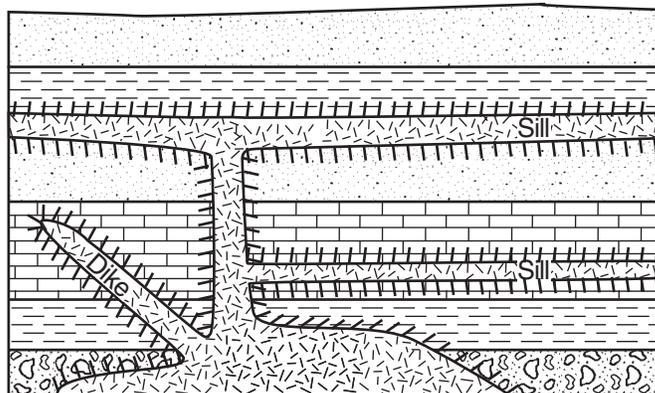
48 The block diagram below shows the bedrock age as measured by radioactive dating and the present location of part of the Hawaiian Island chain. These volcanic islands may have formed as the Pacific Plate moved over a mantle hot spot.



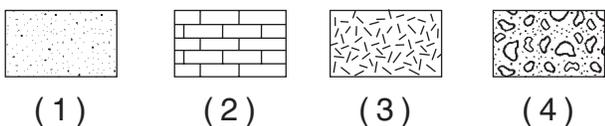
This diagram provides evidence that the Pacific Crustal Plate was moving toward the

- (1) south
- (2) east
- (3) southwest
- (4) northwest

Base your answers to questions 49 and 50 on the geologic cross section below. Overturning has not occurred. The dike and sills shown in the cross section are igneous intrusions.



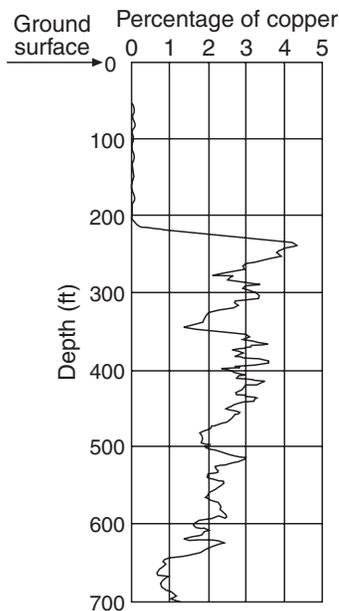
49 Which rock type is the oldest?



50 Which feature is represented by the symbol  along the edges of the dike and sills?

- (1) contact metamorphic rock
- (2) an unconformity
- (3) a glacial moraine
- (4) index fossils

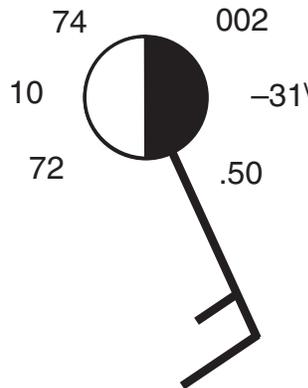
51 The graph below shows the concentration (percentage) of copper at various depths in the bedrock at a mine in Arizona.



Between which depths should the bedrock be mined in order to obtain rock with the highest percentage of copper?

- (1) 100–130 ft
- (2) 230–260 ft
- (3) 330–360 ft
- (4) 650–680 ft

52 The station model below shows the weather conditions at Massena, New York, at 9 a.m. on a particular day in June.



What was the barometric pressure at Massena 3 hours earlier on that day?

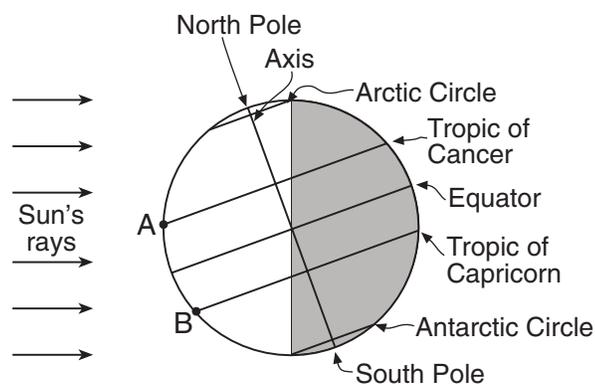
- (1) 997.1 mb
- (2) 999.7 mb
- (3) 1003.3 mb
- (4) 1009.1 mb

Part B-2

Answer all questions in this part.

Directions (53–59): 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 53 through 55 on the diagram below, which represents Earth at a specific position in its orbit as viewed from space. The shaded area represents nighttime. Points A and B are locations on Earth's surface.



- 53 *a* State the month in which Earth is at the position shown in the diagram. [1]
- b* State the latitude that receives the most intense radiation from the Sun when Earth is at this position in its orbit. [1]
- 54 Describe the length of daylight at point A compared to the length of daylight at point B on the day represented by the diagram. [1]
- 55 The model of Earth provided *in your answer booklet* represents Earth in its orbit *6 months later*. On the model shown *in your answer booklet*
- draw the position of Earth's axis and label the axis [1]
 - label the North Pole [1]
 - draw the position of Earth's Equator and label the Equator [1]
-

Base your answers to questions 56 through 59 on the field map provided in your answer booklet. The field map shows air temperature at specific locations in an area near a school in New York State. Part of this area is a blacktop parking lot. Accurate temperature readings were taken by Earth science students at 10 a.m. on June 1. Two reference points, *A* and *B*, are shown.

- 56 On the field map provided, draw only the 15°C and the 20°C isotherms. Isotherms must be extended to the edge of the map. [2]
- 57 Surface temperatures are higher on the east side of the field map, where the parking lot is located. Explain how a characteristic of the parking lot surface could cause these higher temperatures. [1]
- 58 Calculate the temperature gradient along a straight line between point *A* and point *B* on the map by following the directions below.
- a* Write the equation for determining the temperature gradient.
 - b* Substitute the correct values into the equation. [1]
 - c* Solve the equation and record your answer in decimal form. Label the answer with the correct units. [2]
- 59 Another Earth science class took accurate temperature readings at 12 noon on the same day and at the same locations. At each location, the temperature was warmer than it had been at 10 a.m. Explain why the temperature readings would normally increase between 10 a.m. and 12 noon. [1]
-

Part C

Answer all questions in this part.

Directions (60–72): 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 60 through 62 on the notes below written by a student during field trips to three different locations in New York State.

NOTES

Location A

Good view from this hilltop; chilly and windy. We rested to catch our breath, then collected samples. Rocks are visible everywhere. There are boulders, cobbles, and pebbles of many sizes and shapes mixed together. These surface rock fragments are composed of metamorphic rock sitting on the limestone bedrock. The teacher showed us parallel scratches in the bedrock. I saw almost no soil.

Location B

It is rocky and the streambank is steep. Where we are standing, we can see a waterfall and rapids. It is cool by the water. From the streambed we collected pebbles and cobbles — some red, some white, others a mixture of many colors. The streambed is full of rocks of all sizes. The teacher warned us to be careful of the strong stream current.

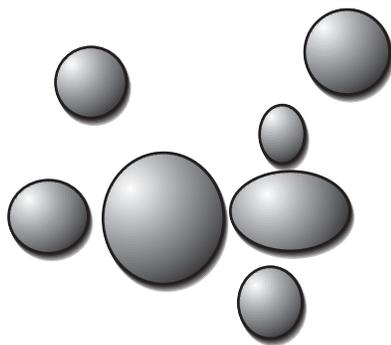
Location C

It is cool in the shade, and the rock cliff above us still has some ice on it from winter. The rocks we are sitting on have sharp edges. Rock fragments at the bottom of the cliff are the same color as the cliff. Our teacher warned us to watch out for falling rocks.

60 *a* State the agent of erosion that deposited most of the sediment found at location A. [1]

b State *one* observation recorded by the student that supports this conclusion. [1]

61 Some samples of sediment collected from the streambed at location B are shown below.



Explain why these samples are smooth and have rounded shapes. [1]

62 Explain how ice in cracks on the cliff at location C may have helped cause weathering of the bedrock on the face of the cliff. [1]

Base your answers to questions 63 through 65 on the table below, which shows the concentration of ozone, in ozone units, in Earth's atmosphere at different altitudes. [One ozone unit is equal to 10^{12} molecules per cubic centimeter.]

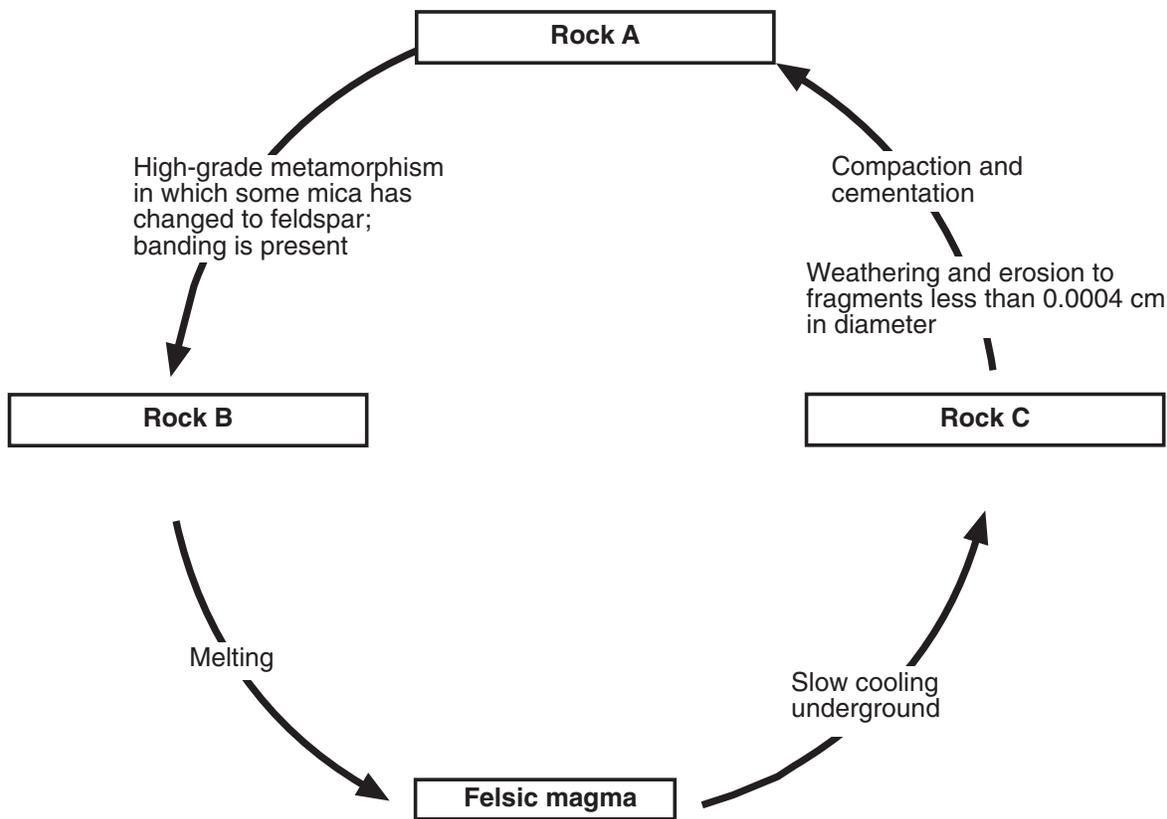
Concentration of Ozone	
Altitude (km)	Ozone Units
0	0.7
5	0.6
10	1.1
15	3.0
20	4.9
25	4.4
30	2.6
35	1.4
40	0.6
45	0.2
50	0.1
55	0.0

- 63 On the grid provided *in your answer booklet*, construct a line graph of the ozone concentration in the atmosphere recorded at the different altitudes shown on the table by plotting the data from the table and connecting the points. [3]
- 64 State the name of the temperature zone of the atmosphere in which the concentration of ozone is greatest. [1]
- 65 State how incoming solar radiation (insolation) is affected by the ozone in the atmosphere. [1]
-

Base your answers to questions 66 through 70 on the weather satellite photograph of a portion of the United States and Mexico provided in your answer booklet. The photograph shows the clouds of a major hurricane approaching the eastern coastline of Texas and Mexico. The calm center of the hurricane, the eye, is labeled.

- 66 This hurricane has a pattern of surface winds typical of all low-pressure systems in the Northern Hemisphere. On the satellite photograph provided, draw *three* arrows on the clouds to show the direction of the surface wind movement outside the eye of the hurricane. [1]
- 67 Cloud droplets form around small particles in the atmosphere. Describe how the hurricane clouds formed from water vapor. Include the terms “dewpoint” and either “condensation” or “condense” in your answer. [1]
- 68 State the latitude and longitude of the hurricane’s eye. The compass directions must be included in the answer. [1]
- 69 At the location shown in the photograph, the hurricane had maximum winds recorded at 110 miles per hour. Within a 24-hour period, the hurricane moved 150 miles inland and had maximum winds of only 65 miles per hour. State why the wind velocity of a hurricane usually decreases when the hurricane moves over a land surface. [1]
- 70 *a* State *two* dangerous conditions, other than hurricane winds, that could cause human fatalities as the hurricane strikes the coast. [2]
- b* Describe *one* emergency preparation humans could take to avoid a problem caused by one of these dangerous conditions. [1]
-

Base your answers to questions 71 and 72 on the rock cycle diagram below.



71 State the specific names of rocks *A*, *B*, and *C* in the diagram. Do *not* write the terms “sedimentary,” “igneous,” and “metamorphic.” [3]

72 State *one* condition or process that would cause the high-grade metamorphism of rock *A*. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Thursday, August 16, 2001 — 12:30 to 3:30 p.m., only

ANSWER SHEET

Student Sex: Male Female Grade

Teacher School

Record your answers to Part A and Part B-1 on this answer sheet.

Part A

- 1 13 25
- 2 14 26
- 3 15 27
- 4 16 28
- 5 17 29
- 6 18 30
- 7 19 31
- 8 20 32
- 9 21 33
- 10 22 34
- 11 23 35
- 12 24

Part A Score

Part B-1

- 36 45
- 37 46
- 38 47
- 39 48
- 40 49
- 41 50
- 42 51
- 43 52
- 44

Part B-1 Score

Write your answers to Part B-2 and Part C in your answer booklet.

The declaration below should be signed when you have completed the examination.

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.

Tear Here

Signature

Tear Here

Tear Here

**PHYSICAL SETTING
 EARTH SCIENCE**

Thursday, August 16, 2001 — 12:30 to 3:30 p.m., only

ANSWER BOOKLET Male

Student Sex: Female

Teacher

School Grade

Answer all questions in Part B-2 and Part C. Record your answers in this booklet.

Performance Test Score (Maximum Score: 23)		<input type="text"/>
.....		
Part	Maximum Score	Student's Score
A	35	
B-1	17	
B-2	13	
C	20	
Total Written Test Score (Maximum Raw Score: 85)		<input type="text"/>
Final Score (from conversion chart)		<input type="text"/>
Raters' Initials:		
Rater 1 Rater 2		

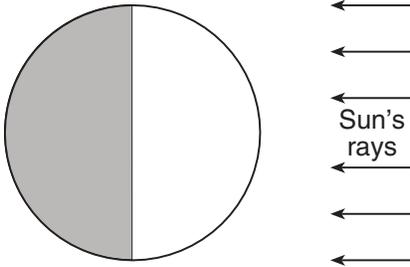
Part B-2

For Raters Only

53 a _____
 b _____

54 _____

55



Earth's position in its orbit 6 months later

53 a

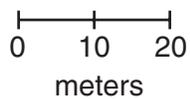
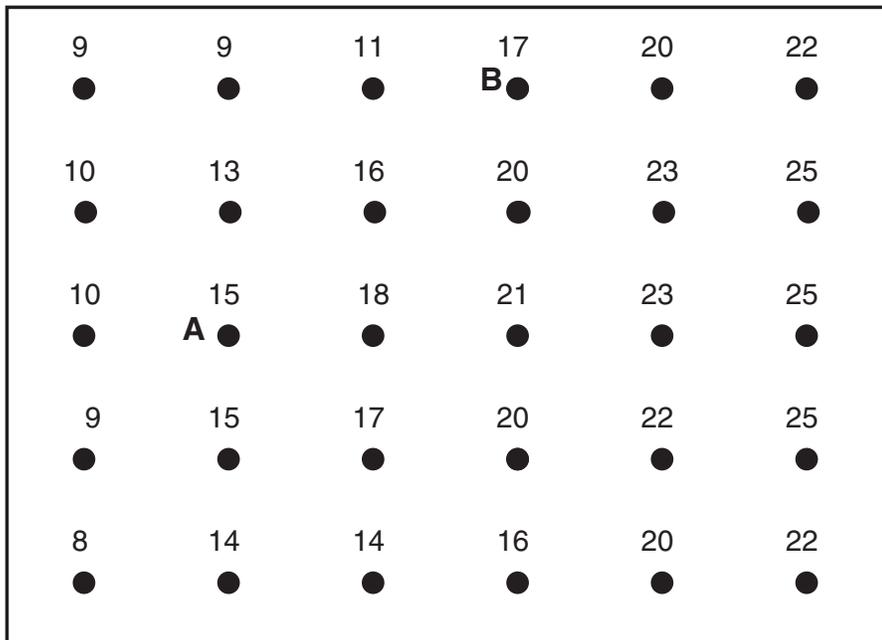
53 b

54

55

56

Ground-Level Air Temperature (°C)



56

57

57

58

a

b

c

58 *b*

58 *c*

59

59

[b]

Part C

For Raters Only

60 *a* _____

60 *a*

b _____

60 *b*

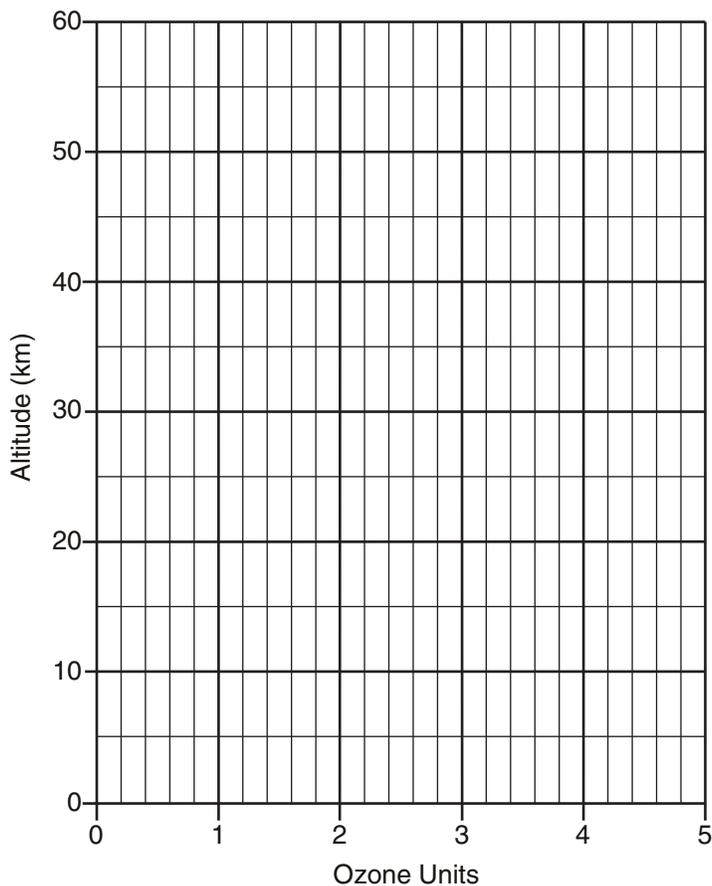
61 _____

61

62 _____

62

63



63

64 _____

64

65 _____

65

66

100° W

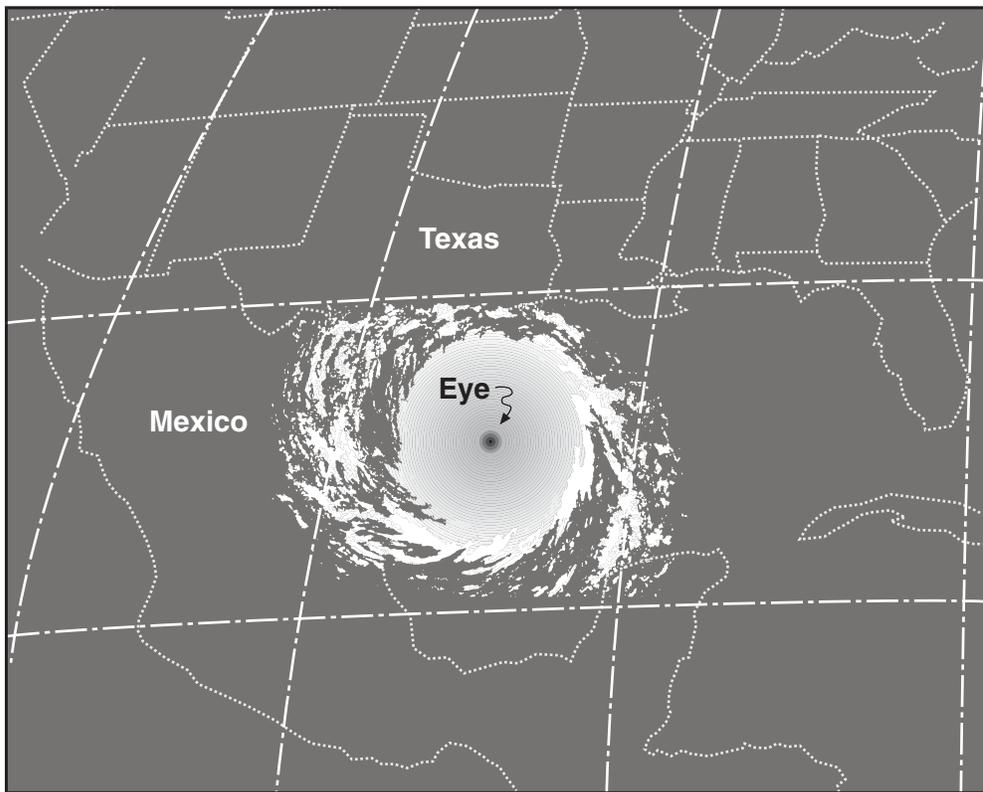
90° W

30° N

30° N

25° N

25° N



66

67

67

68

_____ and _____
(latitude) (longitude)

68

69

69

70 a

_____ and _____

70a

b

70b

71 Rock A

Rock B

Rock C

71

72

72

[d]

Total Score for Part C