The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Thursday, August 16, 2007 — 12:30 p.m. 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 (Revised November 2006)* of these reference tables before you begin the examination.

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

The answers to the questions in Part B–2 and Part C are to be written in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

You are to answer *all* questions in all parts of this examination according to the directions provided in the examination booklet. Record your answers to the Part A and Part B–1 multiple-choice questions on your separate answer sheet. Write your answers to the Part B–2 and Part C questions in your answer booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on your separate answer sheet and in your answer booklet.

When you have completed the examination, you must sign the statement printed at the end of your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet and answer booklet cannot be accepted if you fail to sign this declaration.

Notice. . .

A four-function or scientific calculator and a copy of the *2001 Earth Science Reference Tables (Revised November 2006)* must be available for you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

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

Part A

Answer all questions in this part.

Directions (1–35): For *each* statement or question, write on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Earth Science Reference Tables*.

1 Scientists can plan to photograph a solar eclipse because most astronomical events are

(1) cyclic and predictable
(2) cyclic and unpredictable
(3) random and predictable
(4) random and unpredictable

2 The Coriolis effect causes winds in New York State to generally curve

(1) to the right of the direction of travel
(2) to the left of the direction of travel
(3) upward away from Earth's surface
(4) downward toward Earth's surface

3 In New York State, the constellation Pisces can be seen in the night sky between the middle of summer and the middle of winter. The constellation Scorpio can be seen in the night sky between early spring and early fall. The reason these two constellations can be viewed only at these times is a direct result of Earth's

(1) spin on its axis
(2) movement around the Sun
(3) axis having a 23.5° tilt
(4) distance from the Sun

4 Approximately how many degrees per day does Earth revolve in its orbit around the Sun?

(1) 1° (3) 15°
(2) 13° (4) 23.5°

5 Compared with our Sun, the star *Betelgeuse* is

(1) smaller, hotter, and less luminous
(2) smaller, cooler, and more luminous
(3) larger, hotter, and less luminous
(4) larger, cooler, and more luminous

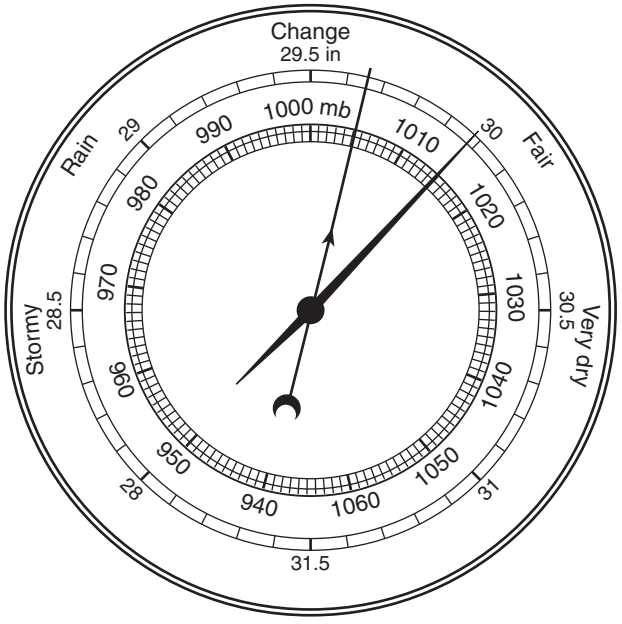
6 Astronomers viewing light from distant galaxies observe a shift of spectral lines toward the red end of the visible spectrum. This shift provides evidence that

(1) orbital velocities of stars are decreasing
(2) Earth's atmosphere is warming
(3) the Sun is cooling
(4) the universe is expanding

7 How many calories are required to evaporate 1 gram of boiling water?

(1) 1 (3) 540
(2) 80 (4) 620

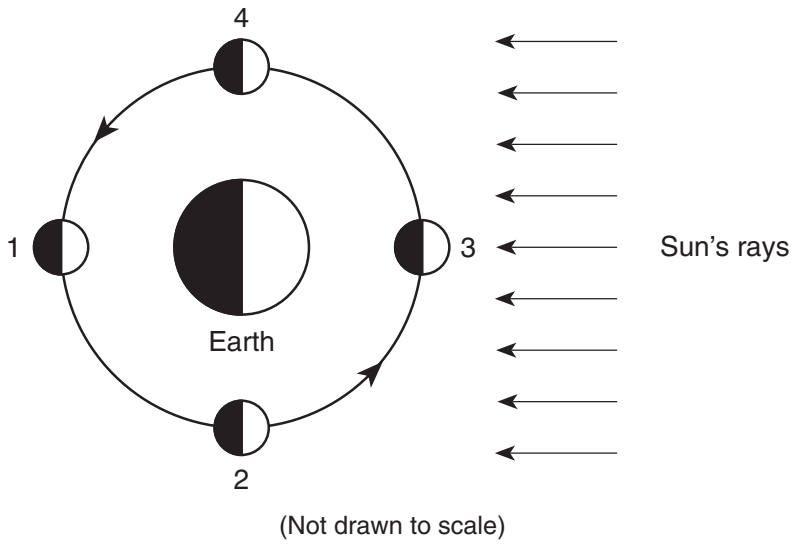
8 A weather instrument is shown below.



Which weather variable is measured by this instrument?

(1) wind speed (3) cloud cover
(2) precipitation (4) air pressure

9 The diagram below represents the Sun's rays striking Earth and the Moon. Numbers 1 through 4 represent positions of the Moon in its orbit around Earth.



(Not drawn to scale)

The highest tides on Earth occur when the Moon is in positions

(1) 1 and 3
(2) 2 and 4
(3) 3 and 2
(4) 4 and 1

10 Most of the solar radiation absorbed by Earth's surface is later radiated back into space as which type of electromagnetic radiation?

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

11 In the United States, most tornadoes are classified as intense

(1) low-pressure funnel clouds that spin clockwise
(2) low-pressure funnel clouds that spin counterclockwise
(3) high-pressure funnel clouds that spin clockwise
(4) high-pressure funnel clouds that spin counterclockwise

12 Which type of air mass is associated with warm, dry atmospheric conditions?

(1) cP
(2) cT
(3) mP
(4) mT

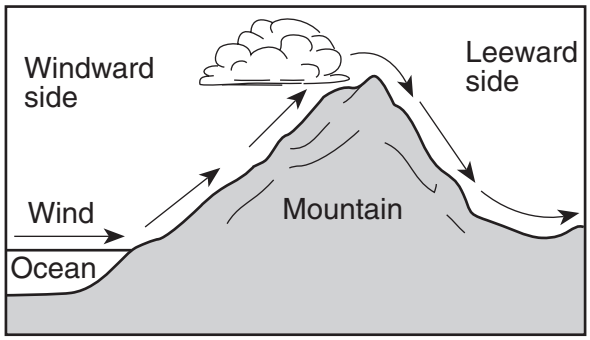
13 The approximate latitude of Utica, New York, is

(1) 43°05' N
(2) 43°05' S
(3) 75°15' E
(4) 75°15' W

14 Earth's surface winds generally blow from regions of higher

(1) air temperature toward regions of lower air temperature
(2) air pressure toward regions of lower air pressure
(3) latitudes toward regions of lower latitudes
(4) elevations toward regions of lower elevations

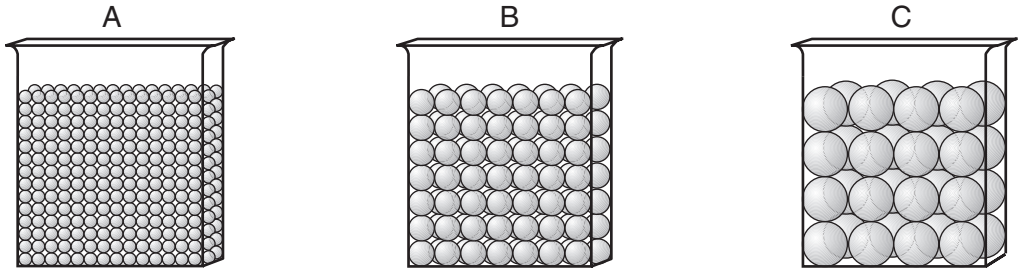
15 The diagram below shows how prevailing winds cause different weather conditions on the windward and leeward sides of a mountain range.



Clouds usually form on the windward sides of mountains because this is where air

(1) rises and cools
(2) rises and warms
(3) sinks and cools
(4) sinks and warms

16 The diagrams below represent three containers, *A*, *B*, and *C*, which were filled with equal volumes of uniformly sorted plastic beads. Water was poured into each container to determine porosity and infiltration time.



(Not drawn to scale)

Which data table best represents the porosity and infiltration time of the beads in the three containers?

Beaker	Porosity (%)	Infiltration Time (sec)
A	40	5.2
B	40	2.8
C	40	0.4

(1)

Beaker	Porosity (%)	Infiltration Time (sec)
A	20	5.2
B	30	2.8
C	40	0.4

(3)

Beaker	Porosity (%)	Infiltration Time (sec)
A	40	0.4
B	40	2.8
C	40	5.2

(2)

Beaker	Porosity (%)	Infiltration Time (sec)
A	20	0.4
B	30	2.8
C	40	5.2

(4)

17 Which ocean current brings warm water to the western coast of Africa?

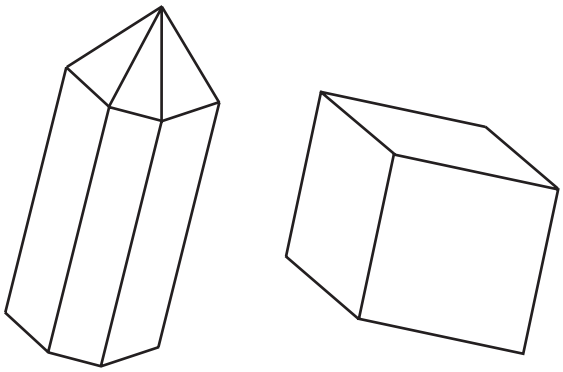
(1) Agulhas Current
(2) North Equatorial Current
(3) Canaries Current
(4) Guinea Current

18 The map below shows the large delta that formed as the Mississippi River emptied into the Gulf of Mexico.

Which process was primarily responsible for the formation of the delta?

(1) glacial erosion
(2) cementation of sediment
(3) deposition of sediment
(4) mass movement

19 The diagrams below show the crystal shapes of two minerals.



Quartz and halite have different crystal shapes primarily because

(1) light reflects from crystal surfaces
(2) energy is released during crystallization
(3) of impurities that produce surface variations
(4) of the internal arrangement of the atoms

20 A student created the table below by classifying six minerals into two groups, *A* and *B*, based on a single property.

Group A	Group B
olivine	pyrite
garnet	galena
calcite	graphite

Which property was used to classify these minerals?

(1) color
(2) luster
(3) chemical composition
(4) hardness

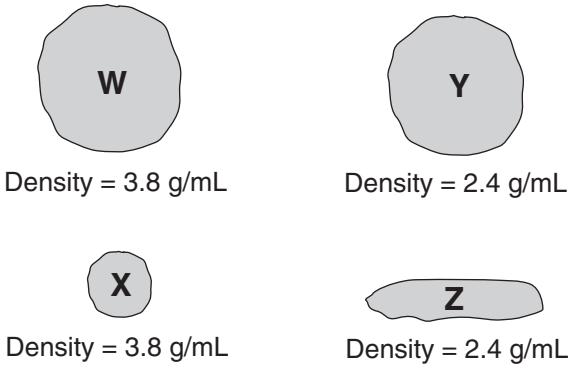
21 Which igneous rock has a vesicular texture and contains the minerals potassium feldspar and quartz?

(1) andesite
(2) pegmatite
(3) pumice
(4) scoria

22 Dolostone is classified as which type of rock?

(1) land-derived sedimentary rock
(2) chemically formed sedimentary rock
(3) foliated metamorphic rock
(4) nonfoliated metamorphic rock

23 A stream is transporting the particles *W*, *X*, *Y*, and *Z*, shown below.



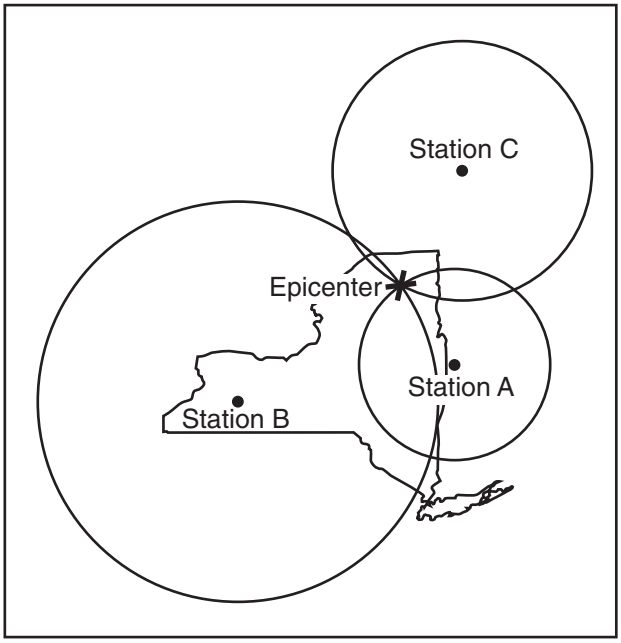
Which particle will most likely settle to the bottom first as the velocity of this stream decreases?

(1) *W*
(2) *X*
(3) *Y*
(4) *Z*

24 What is Earth's inferred interior pressure, in millions of atmospheres, at a depth of 3500 kilometers?

(1) 1.9
(2) 2.8
(3) 5500
(4) 6500

25 The map below shows the location of an earthquake epicenter in New York State. Seismic stations *A*, *B*, and *C* received the data used to locate the earthquake epicenter.



The seismogram recorded at station *A* would show the

(1) arrival of *P*-waves, only
(2) earliest arrival time of *P*-waves
(3) greatest difference in the arrival times of *P*-waves and *S*-waves
(4) arrival of *S*-waves before the arrival of *P*-waves

26 An earthquake's first *P*-wave arrives at a seismic station at 12:00:00. This *P*-wave has traveled 6000 kilometers from the epicenter. At what time will the first *S*-wave from the same earthquake arrive at the seismic station?

(1) 11:52:20
(2) 12:07:40
(3) 12:09:20
(4) 12:17:00

27 The movement of tectonic plates is inferred by many scientists to be driven by

(1) tidal motions in the hydrosphere
(2) density differences in the troposphere
(3) convection currents in the asthenosphere
(4) solidification in the lithosphere

28 Which two tectonic plates are separated by a mid-ocean ridge?

(1) Indian-Australian and Eurasian
(2) Indian-Australian and Pacific
(3) North American and South American
(4) North American and Eurasian

29 The presence of brachiopod, nautiloid, and coral fossils in the surface bedrock of a certain area indicates the area was once covered by

(1) tropical vegetation
(2) glacial deposits
(3) volcanic ash
(4) ocean water

30 New York State's Catskills are classified as which type of landscape region?

(1) mountain
(2) plateau
(3) lowland
(4) plain

31 What is the relative humidity if the dry-bulb temperature is 22°C and the wet-bulb temperature is 17°C?

(1) 5%
(2) 14%
(3) 60%
(4) 68%

32 The time line below represents the entire geologic history of Earth.

Which letter best represents the first appearance of humans on Earth?

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

33 Three extinct organisms are shown in the diagrams below.

Cystiphyllum, a solitary coral

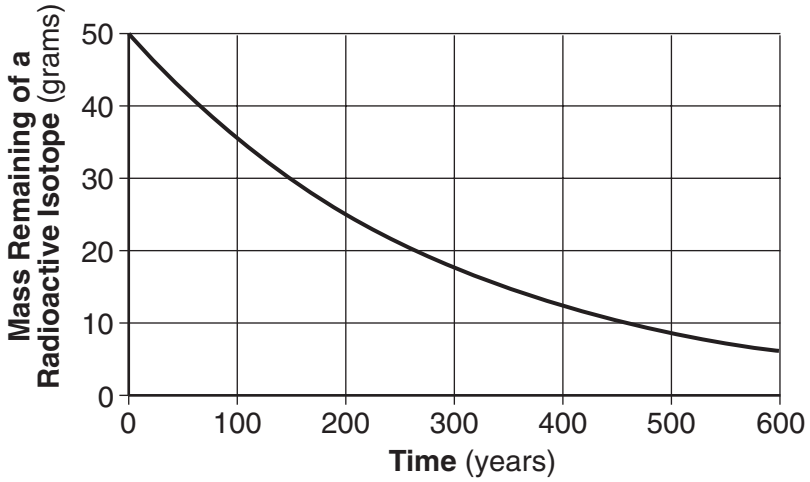
Baragwanathia, a lycopod — an early land plant

Palaeophonus, a scorpion — one of the first land animals

Which other life-form reached its peak development during the same period in geologic history that these three life-forms first appeared on Earth?

(1) dinosaurs
(2) stromatolites
(3) mastodonts
(4) eurypterids

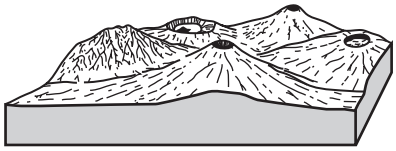
34 The graph below shows the radioactive decay of a 50-gram sample of a radioactive isotope.



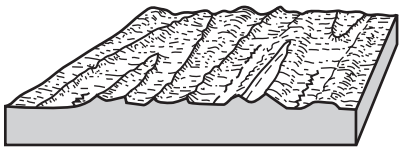
According to the graph, what is the half-life of this isotope?

(1) 100 years
(2) 150 years
(3) 200 years
(4) 300 years

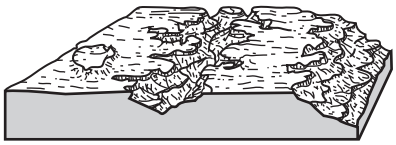
35 Which diagram represents a landscape where fine-grained igneous bedrock is most likely to be found?



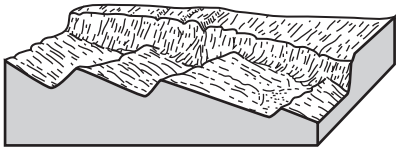
(1)



(3)



(2)



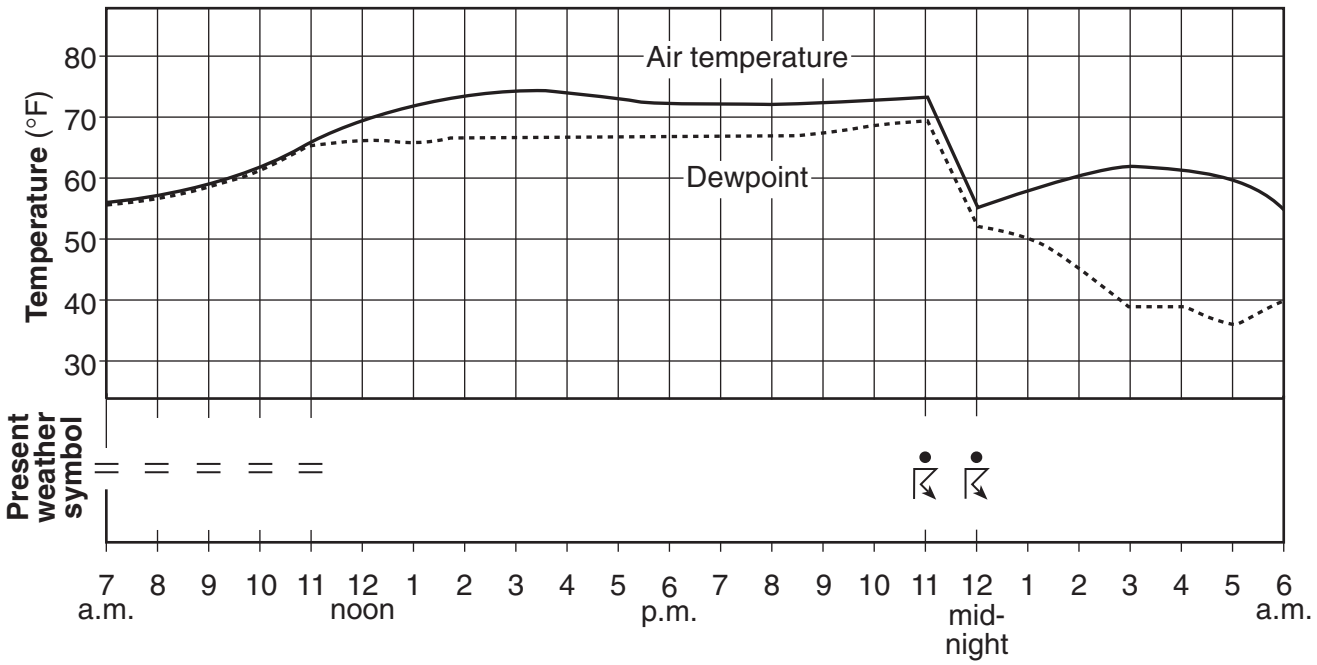
(4)

Part B–1

Answer all questions in this part.

Directions (36–50): For *each* statement or question, write on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 36 and 37 on the graph below, which shows air temperature, dewpoint, and present weather conditions for a 23-hour period at Dallas, Texas.



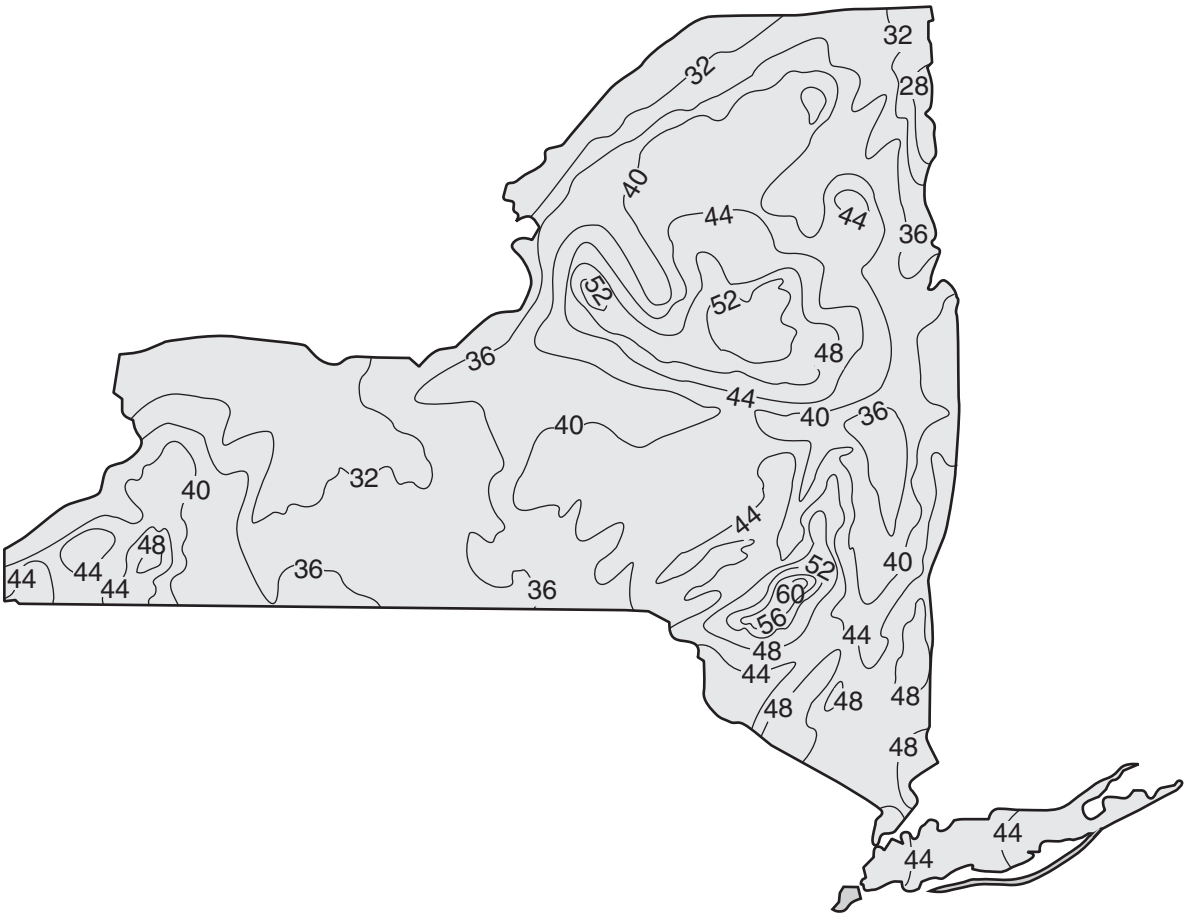
36 The thunderstorm that occurred between 11 p.m. and 12 midnight was most likely the result of

(1) the arrival of a warm front
(2) the arrival of a cold front
(3) an increase in the difference between air temperature and dewpoint
(4) an increase in both air temperature and dewpoint

37 Which weather condition was reported at Dallas when the air temperature was equal to the dewpoint?

(1) fog
(2) rain
(3) thunderstorm
(4) drizzle

Base your answers to questions 38 and 39 on the isoline map below, which shows the average yearly precipitation, in inches, across New York State.



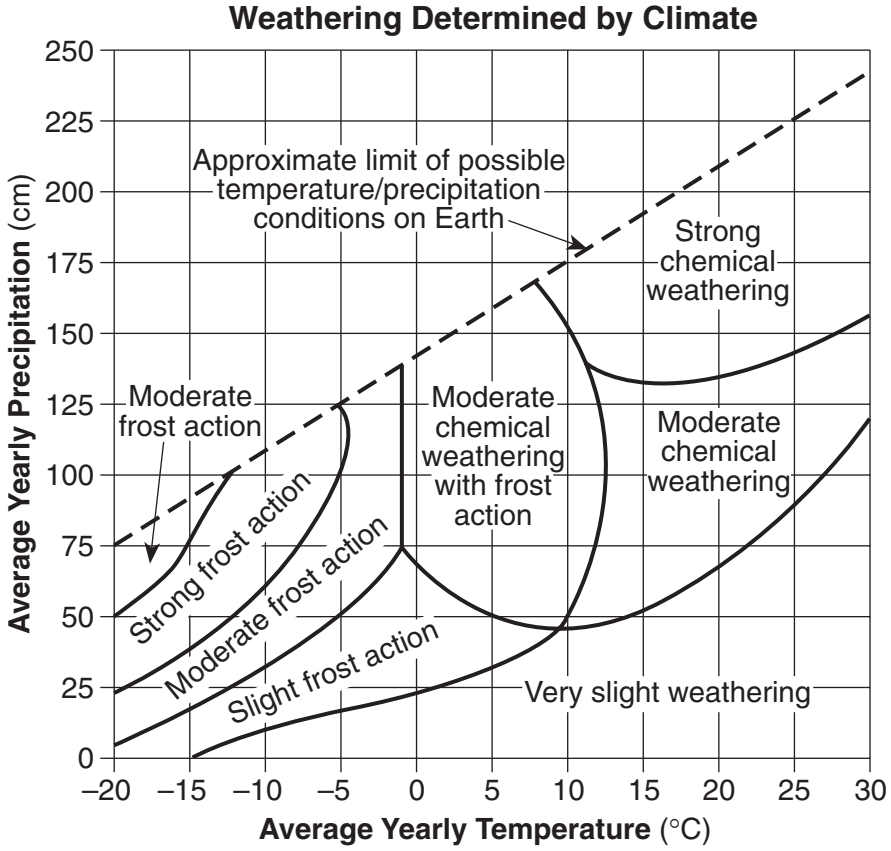
38 Which New York State landscape region receives the greatest average yearly precipitation?

(1) Catskills
(2) Tug Hill Plateau
(3) Adirondack Mountains
(4) Taconic Mountains

39 Approximately how many inches of average yearly precipitation does Rochester, New York, receive?

(1) 26
(2) 30
(3) 38
(4) 42

Base your answers to questions 40 and 41 on the graph below, which shows the effect that average yearly precipitation and temperature have on the type of weathering that will occur in a particular region.



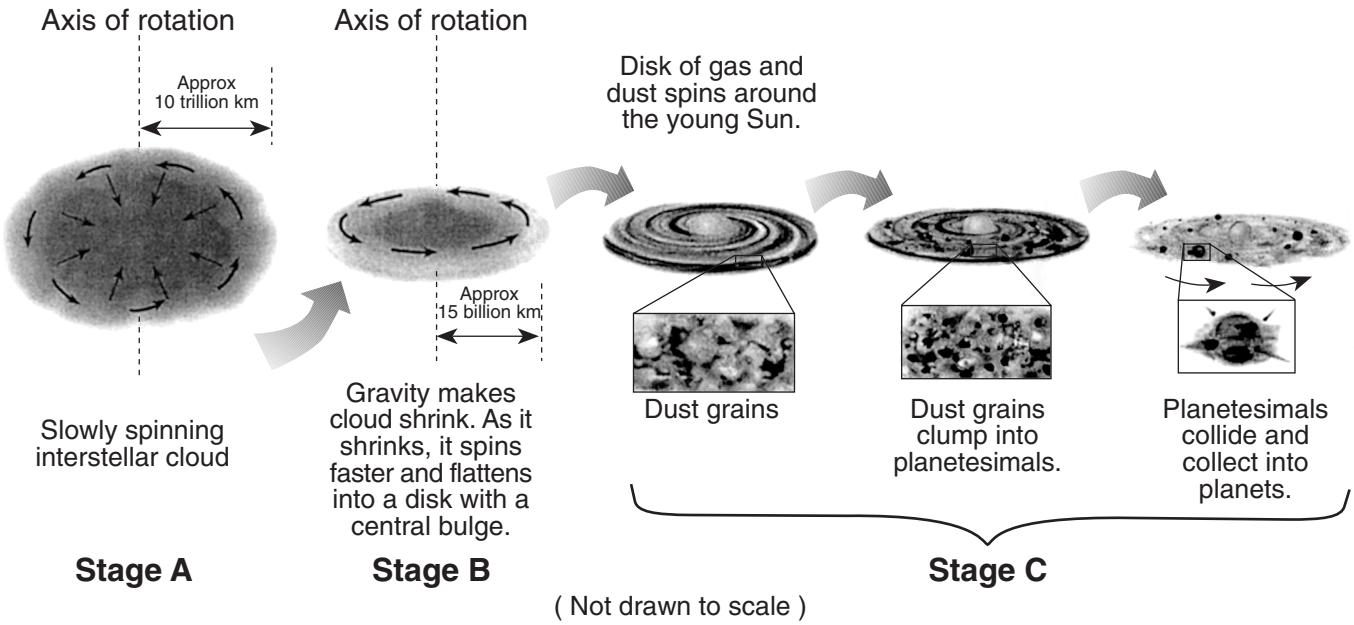
40 Which type of weathering is most common where the average yearly temperature is 5°C and the average yearly precipitation is 45 cm?

(1) moderate chemical weathering
(2) very slight weathering
(3) moderate chemical weathering with frost action
(4) slight frost action

41 The amount of chemical weathering will increase if

(1) air temperature decreases and precipitation decreases
(2) air temperature decreases and precipitation increases
(3) air temperature increases and precipitation decreases
(4) air temperature increases and precipitation increases

Base your answers to questions 42 and 43 on the diagram below, which shows an inferred sequence in which our solar system formed from a giant interstellar cloud of gas and debris. Stage *A* shows the collapse of the gas cloud, stage *B* shows its flattening, and stage *C* shows the sequence that led to the formation of planets.



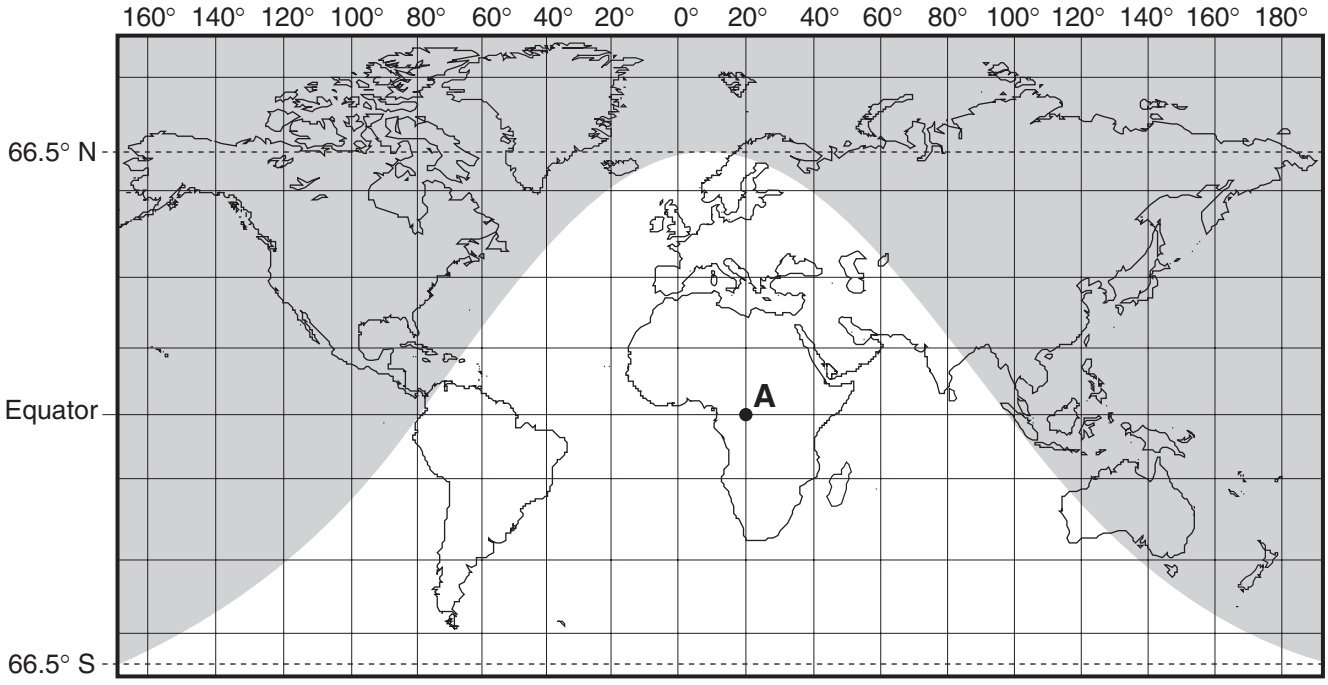
42 From stage *B* to stage *C*, the young Sun was created

(1) when gravity caused the center of the cloud to contract
(2) when gravity caused heavy dust particles to split apart
(3) by outgassing from the spinning interstellar cloud
(4) by outgassing from Earth's interior

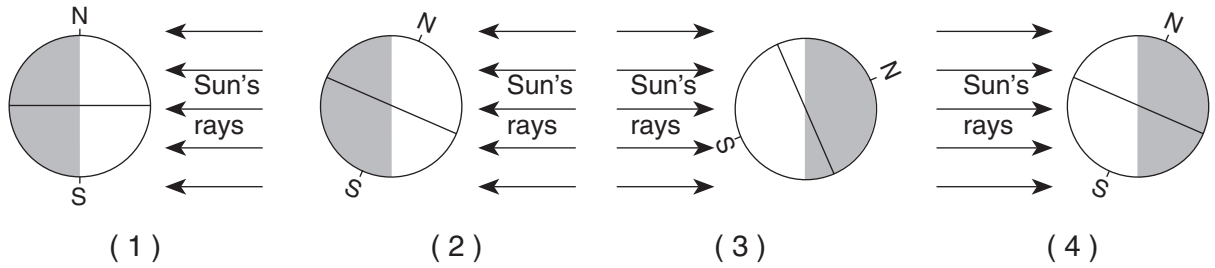
43 After the young Sun formed, the disk of gas and dust

(1) became spherical in shape
(2) formed a central bulge
(3) became larger in diameter
(4) eventually formed into planets

Base your answers to questions 44 through 46 on the world map below. The shaded portion of the map indicates areas of night, and the unshaded portion indicates areas of daylight on a certain day of the year. Dashed latitude lines represent the Arctic Circle (66.5° N) and the Antarctic Circle (66.5° S). Point *A* is a location on Earth's surface.



44 Which diagram shows the position of Earth relative to the Sun's rays on this day?



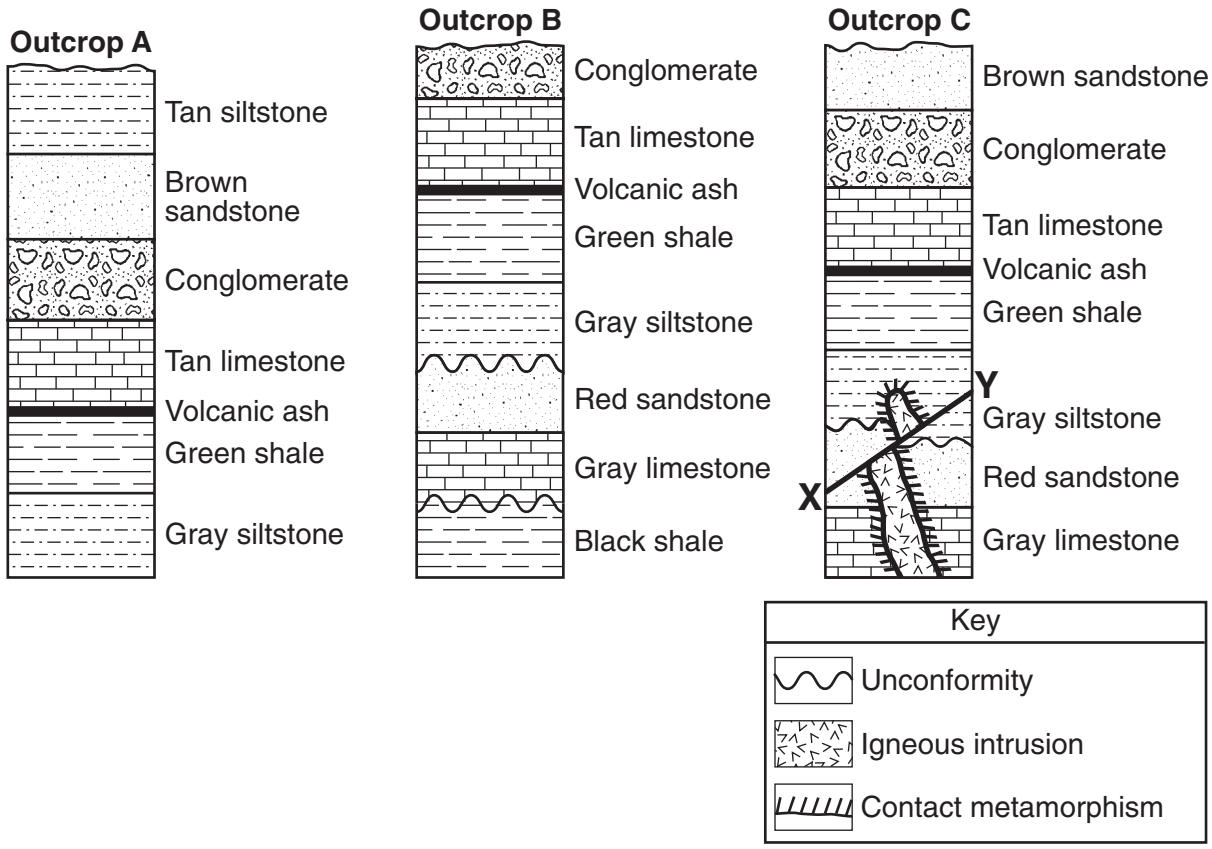
45 Approximately how many hours of daylight would occur at position *A* on this day?

(1) 6
(2) 9
(3) 12
(4) 15

46 On this day, the duration of daylight from the equator to the Arctic Circle

(1) decreases, only
(2) increases, only
(3) decreases, then increases
(4) increases, then decreases

Base your answers to questions 47 through 50 on the cross sections of three rock outcrops, *A*, *B*, and *C*. Line *XY* represents a fault. Overturning has not occurred in the rock outcrops.



47 The volcanic ash layer is considered a good time marker for correlating rocks because the volcanic ash layer

(1) has a dark color
(2) can be dated using carbon-14
(3) lacks fossils
(4) was rapidly deposited over a wide area

48 Which sedimentary rock shown in the outcrops is the youngest?

(1) black shale
(2) conglomerate
(3) tan siltstone
(4) brown sandstone

49 What is the youngest geologic feature in the three bottom layers of outcrop *C*?

(1) fault
(2) igneous intrusion
(3) unconformity
(4) zone of contact metamorphism

50 Which processes were primarily responsible for the formation of most of the rock in outcrop *A*?

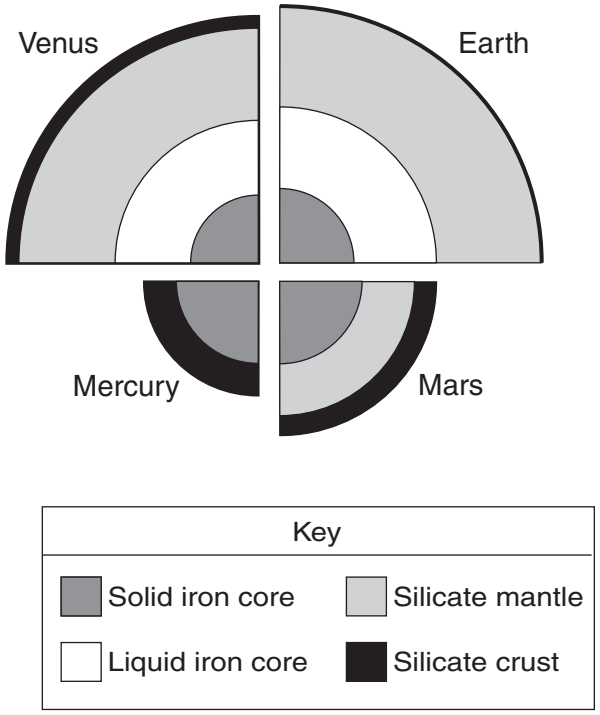
(1) melting and solidification
(2) heating and compression
(3) compaction and cementation
(4) weathering and erosion

Part B–2

Answer all questions in this part.

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

Base your answers to questions 51 through 53 on the diagram below, which shows the inferred internal structure of the four terrestrial planets, drawn to scale.

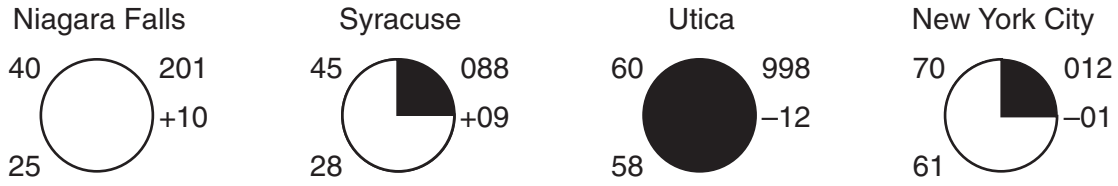


51 How are the crusts of Mars, Mercury, Venus, and Earth similar in composition? [1]

52 Identify the *two* planets that would allow an *S*-wave from a crustal quake to be transmitted through the core to the opposite side of the planet. [1]

53 Explain why the densities of these terrestrial planets are greater than the densities of the Jovian planets. [1]

Base your answers to questions 54 through 56 on the information on the four station models shown below. The weather data were collected at Niagara Falls, Syracuse, Utica, and New York City at the same time.



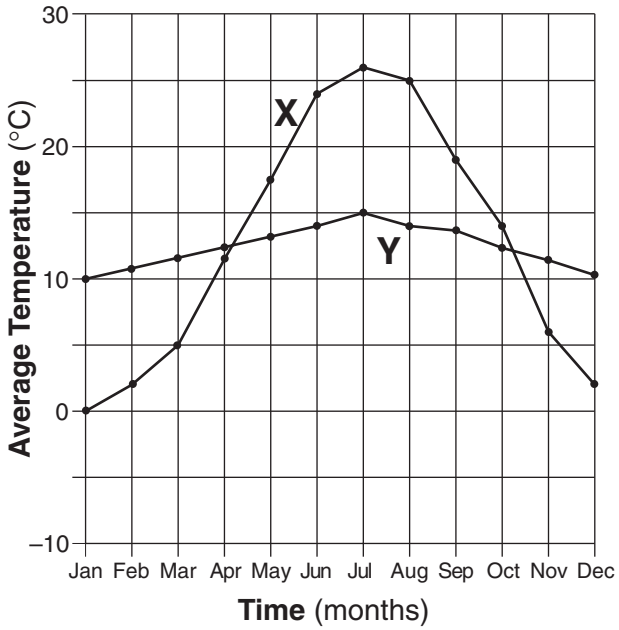
54 What was the air pressure in Niagara Falls? [1]

55 Explain how the weather conditions shown on the station models suggest that Utica had the greatest chance of precipitation. [1]

56 New York City was experiencing a wind blowing from the south at 10 knots with hazy conditions limiting visibility to $\frac{3}{4}$ of a mile. On the station model for New York City *in your answer booklet*, place, in the proper location and format, the information below. [2]

- wind direction
- wind speed
- present weather
- visibility

Base your answers to questions 57 through 59 on the graph below, which shows the average monthly temperatures for a year for city *X* and city *Y*. Both cities are located at the same latitude.

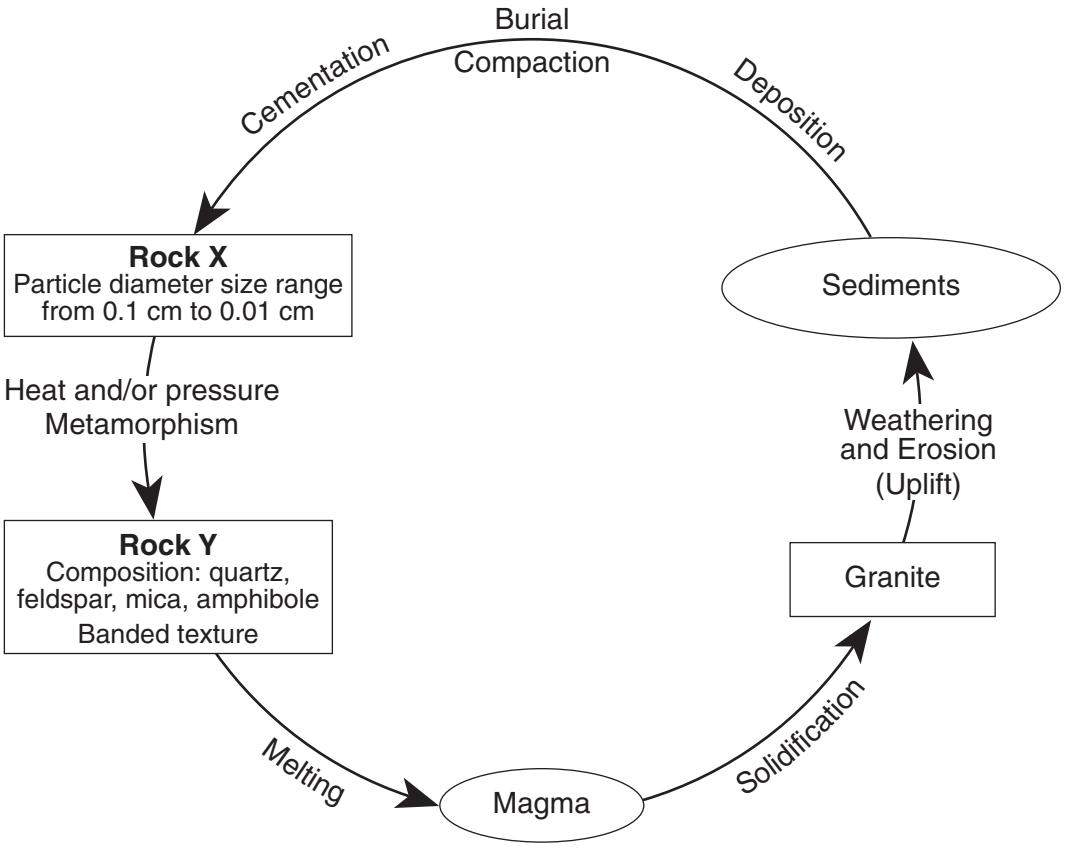


57 What was the range in the average monthly temperatures for city *Y* during the year? [1]

58 Explain why city *X* has a greater difference between summer and winter temperatures than city *Y*. [1]

59 What evidence shown on the graph indicates that both cities, *X* and *Y*, are located in the Northern Hemisphere? [1]

Base your answers to questions 60 through 62 on the diagram below, which represents a part of the rock cycle. The igneous rock, granite, and the characteristics of sedimentary rock *X* and metamorphic rock *Y* are shown.

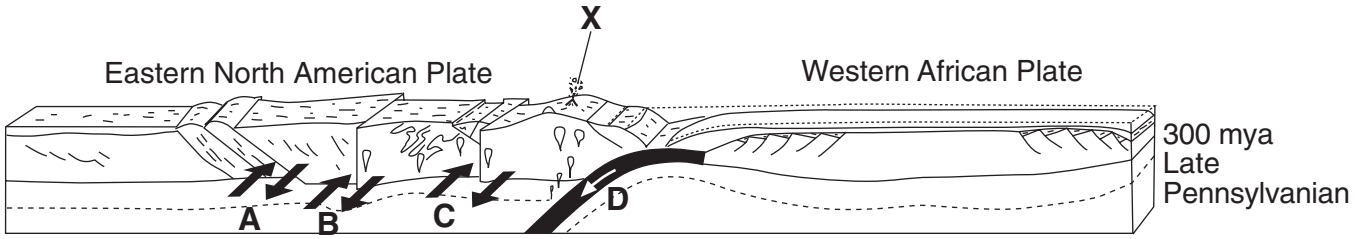


60 Identify sedimentary rock *X*. [1]

61 Identify metamorphic rock *Y*. [1]

62 Complete the table *in your answer booklet,* with descriptions of the observable characteristics used to identify granite. [1]

Base your answers to questions 63 and 64 on the block diagram below. The diagram shows the tectonic plate boundary between Africa and North America 300 million years ago, as these two continents united into a single landmass. The arrows at letters *A*, *B*, *C*, and *D* represent relative crustal movements. Letter *X* shows the eruption of a volcano at that time.



(Not drawn to scale)

63 Identify the type of tectonic plate motion represented by the arrow shown at *D*. [1]

64 Identify the type of tectonic motion represented by the arrows shown at *A*, *B*, and *C*. [1]

Part C

Answer all questions in this part.

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

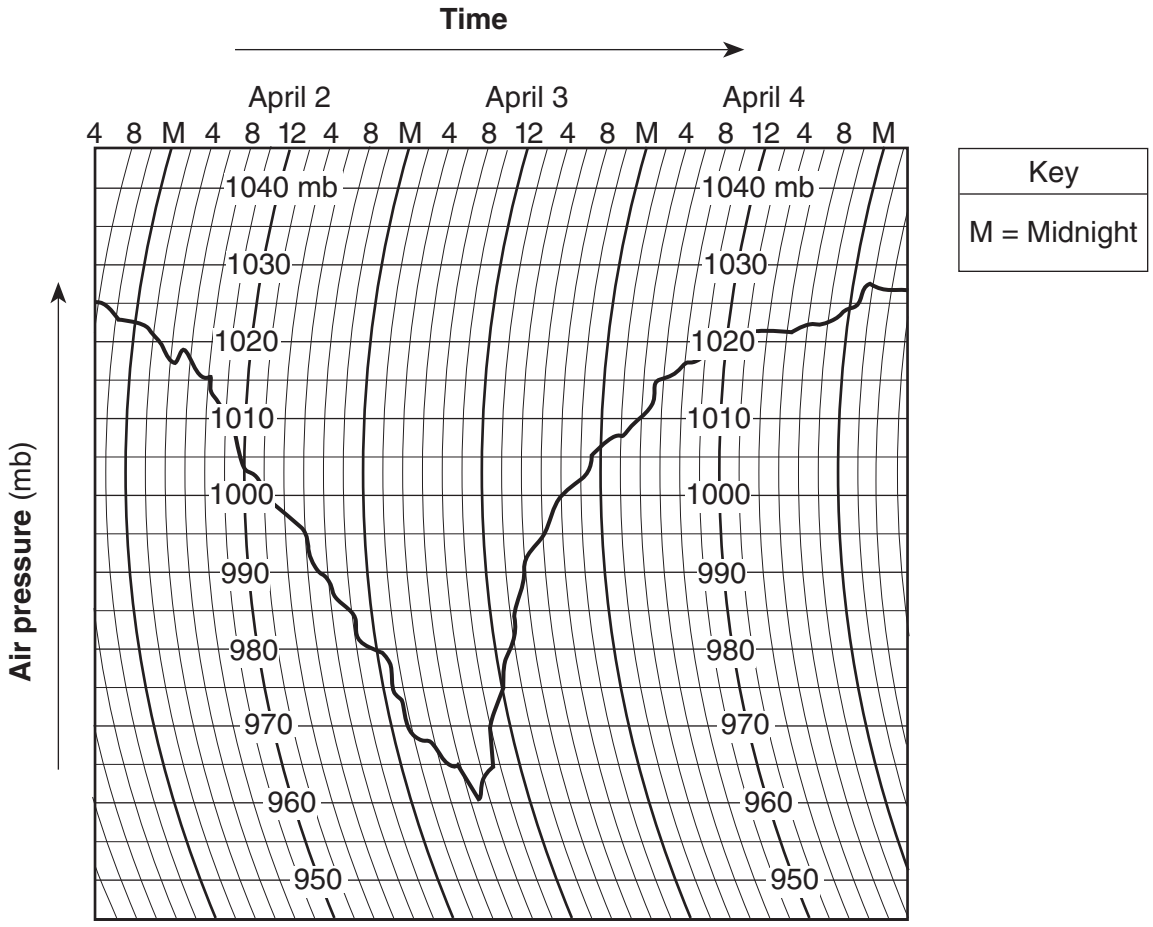
Base your answers to questions 65 through 67 on the diagram in your answer booklet. The diagram shows the positions of Halley's Comet and Asteroid 134340 at various times in their orbits. Specific orbital positions are shown for certain years.

65 The eccentricity of the asteroid's orbit is 0.250. On the orbital diagram *in your answer booklet*, mark the position of the second focus of the asteroid's orbit by placing an **X** on the major axis at the proper location. [1]

66 Determine which was traveling faster, Halley's Comet or the asteroid, between the years 1903 and 1908. State *one* reason for your choice. [1]

67 Explain why Halley's Comet is considered to be part of our solar system. [1]

Base your answers to questions 68 and 69 on the barogram below, which shows air pressure recorded in millibars at Green Bay, Wisconsin, from April 2 through April 4, 1982.



68 Calculate the rate of change in air pressure from 10 a.m. to 8 p.m. on April 3. Label your answer with the correct units. [2]

69 What most likely caused the changes in air pressure for the period of time shown on the graph? [1]

Base your answers to questions 70 through 74 on the passage and the cross section below. The passage describes the geologic history of the Pine Bush region near Albany, New York. The cross section shows the bedrock and overlying sediment along a southwest to northeast diagonal line through a portion of this area. Location *A* shows an ancient buried stream channel and location *B* shows a large sand dune.

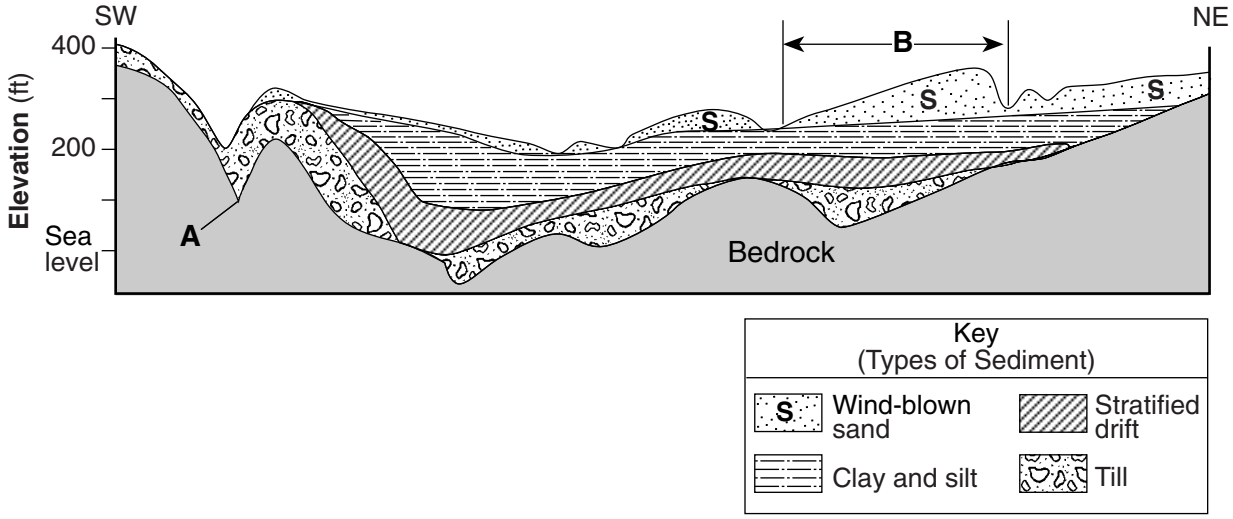
The Pine Bush Region

The Pine Bush region, just northwest of Albany, New York, is a 40-square mile area of sand dunes and wetlands covered by pitch pine trees and scrub oak bushes. During the Ordovician Period, this area was covered by a large sea. Layers of mud and sand deposited in this sea were compressed into shale and sandstone bedrock.

During most of the Cenozoic Era, running water eroded stream channels into the bedrock. One of these buried channels is shown at location *A* in the cross section. Over the last one million years of the Cenozoic Era, this area was affected by glaciation. During the last major advance of glacial ice, soil and bedrock were eroded and later deposited as till (a mixture of boulders, pebbles, sand, and clay).

About 20,000 years ago, the last glacier in New York State began to melt. The meltwater deposited pebbles and sand, forming the stratified drift. During the 5000 years it took to melt this glacier, the entire Pine Bush area became submerged under a large 350-foot-deep glacial lake called Lake Albany. Delta deposits of cobbles, pebbles, and sand formed along the lake shorelines, and beds of silt and clay were deposited farther into the lake.

Lake Albany drained about 12,000 years ago, exposing the lake bottom. Wind erosion created the sand dunes that cover much of the Pine Bush area today.



70 According to the passage, how old is the bedrock shown in the cross section? [1]

71 What evidence shown at location *A* suggests that the channel in the bedrock was eroded by running water? [1]

72 List, from oldest to youngest, the *four* types of sediment shown above the bedrock in the cross section. [1]

73 Explain why the till layer is composed of unsorted sediment. [1]

74 How does the shape of the sand dune at location *B* provide evidence that the prevailing winds that formed this dune were blowing from the southwest? [1]

Base your answers to questions 75 through 77 on the data table below. A student recorded the hours of daylight and the altitude of the Sun at noon on the twenty-first day of every month for one year in Buffalo, New York.

Data Table

Date	Hours of Daylight	Altitude of the Sun at Noon (°)
January 21	9.5	32.3
February 21	10.8	40.1
March 21	12.0	47.3
April 21	13.7	55.1
May 21	14.8	62.5
June 21	15.3	70.4
July 21	14.8	63.3
August 21	13.7	55.5
September 21	12.1	47.7
October 21	10.8	39.9
November 21	9.5	32.1
December 21	9.0	24.4

75 On the graph *in your answer booklet*, draw a line to represent the general relationship between the altitude of the Sun at noon and the number of hours of daylight throughout the year at Buffalo. [1]

76 The sky model diagram *in your answer booklet* shows the apparent path of the Sun on March 21 for an observer in Buffalo, New York. Draw a line to represent the apparent path of the Sun from sunrise to sunset at Buffalo on May 21. Be sure your path indicates the correct altitude of the noon Sun and begins and ends at the correct positions on the horizon. [2]

77 On the same sky model diagram *in your answer booklet*, place an asterisk (✱) at the apparent position of the *North Star* as seen from Buffalo. [1]

Base your answers to questions 78 through 80 on the field map in your answer booklet, which shows an area of a state park where an underground gasoline tank leaked and contaminated the groundwater. Groundwater-monitoring wells were installed to determine the extent of the contamination. The concentration of contaminants in parts per million (ppm) in each of the wells is indicated on the map.

78 On the field map *in your answer booklet*, draw the 50-ppm, 100-ppm, and 150-ppm isolines. The 0-ppm isoline has been drawn for you. [1]

79 State the relationship between the distance from the gasoline tank and the concentration of contaminants in the groundwater. [1]

80 Park officials do not want to see another incident of groundwater contamination from gasoline tanks. State *one* action that park officials could take to prevent gasoline from contaminating the groundwater in the future. [1]

Base your answers to questions 81 and 82 on the hardness of the minerals talc, quartz, halite, sulfur, and fluorite.

81 On the grid *in your answer booklet*, construct a bar graph to represent the hardness of these minerals. [1]

82 Which mineral shown on the grid would be the best abrasive? State *one* reason for your choice. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Thursday, August 16, 2007 — 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	44 .....
37	45 .....
38	46 .....
39	47 .....
40	48 .....
41	49 .....
42	50 .....
43	

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.

Signature

Tear Here

Tear Here

Tear Here

PS/EARTH SCIENCE