

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

PHYSICAL SETTING
EARTH SCIENCE

Wednesday, January 24, 2007 — 9:15 a.m. to 12:15 p.m., only

This is a test of your knowledge of Earth science. Use that knowledge to answer all questions in this examination. Some questions may require the use of the *Earth Science Reference Tables*. The *Earth Science Reference Tables* are supplied separately. Be certain you have a copy of the 2001 edition 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* 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.

6 Which list shows stars in order of increasing temperature?

- (1) *Barnard's Star, Polaris, Sirius, Rigel*
- (2) *Aldebaran, the Sun, Rigel, Procyon B*
- (3) *Rigel, Polaris, Aldebaran, Barnard's Star*
- (4) *Procyon B, Alpha Centauri, Polaris, Betelgeuse*

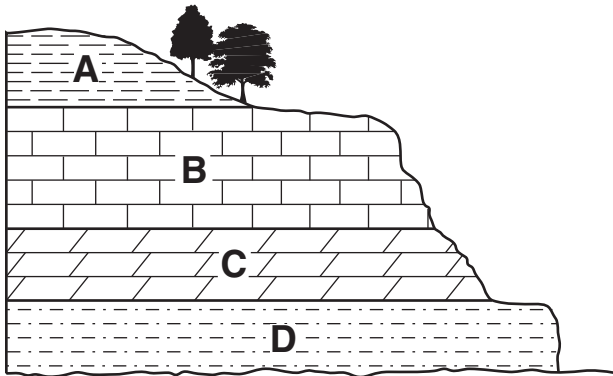
7 Which group of organisms is inferred to have existed for the *least* amount of time in geologic history?

- (1) trilobites
- (2) dinosaurs
- (3) eurypterids
- (4) placoderm fish

8 Which weather variable can be determined by using a psychrometer?

- (1) barometric pressure
- (2) cloud cover
- (3) relative humidity
- (4) wind speed

9 The cross section below shows sedimentary bedrock layers A, B, C, and D exposed at Earth's surface.



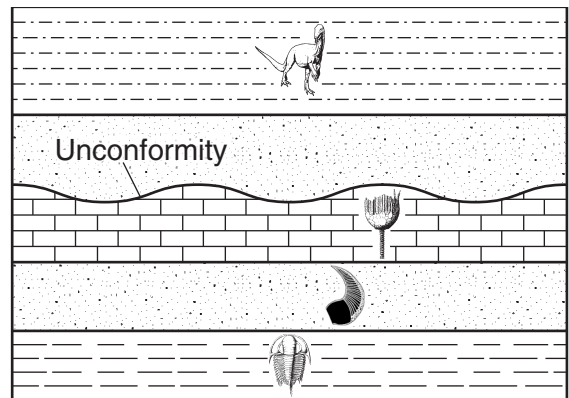
Which layer appears to be the *least* resistant to weathering?

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

10 Which rock was organically formed and sometimes contains fossilized plant impressions?

- (1) rock gypsum
- (2) phyllite
- (3) breccia
- (4) coal

11 The geologic cross section below shows an unconformity in New York State bedrock layers that have not been overturned. Index fossils found throughout some rock layers are shown.



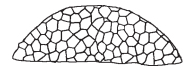
(Not drawn to scale)

Which New York State index fossil may have been present in a rock layer that is missing due to the unconformity?



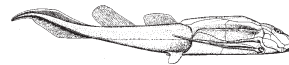
Condor

(1)



Lichenaria

(3)



Bothriolepis

(2)



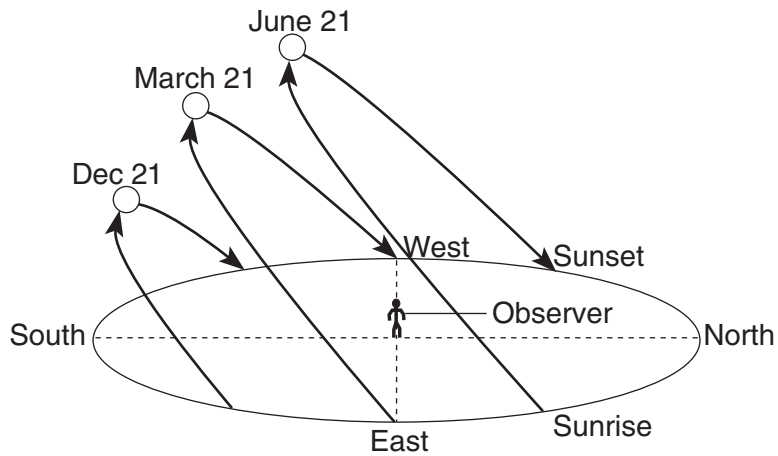
Maclurites

(4)

12 Most scientists believe the Milky Way Galaxy is

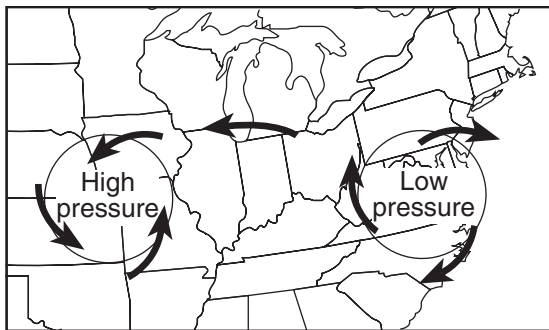
- (1) spherical in shape
- (2) 4.6 billion years old
- (3) composed of stars revolving around Earth
- (4) one of billions of galaxies in the universe

- 13 The diagram below shows the apparent daily path of the Sun, as viewed by an observer at a certain latitude on three different days of the year.

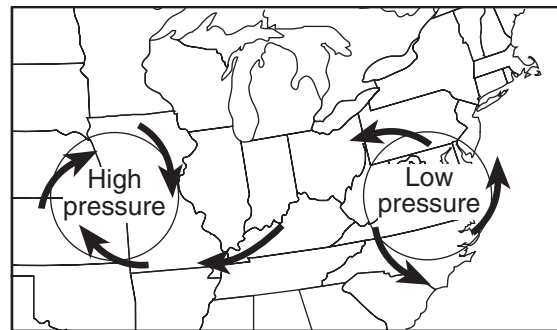


At which latitude were these apparent Sun paths most likely observed?

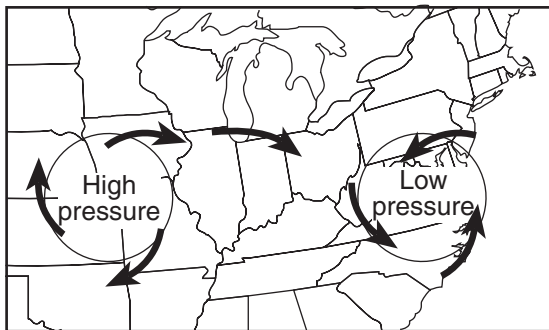
- (1) 0° (3) 43° N
 (2) 23.5° N (4) 66.5° N
- 14 Which map best represents the surface wind pattern associated with high-pressure and low-pressure systems in the Northern Hemisphere?



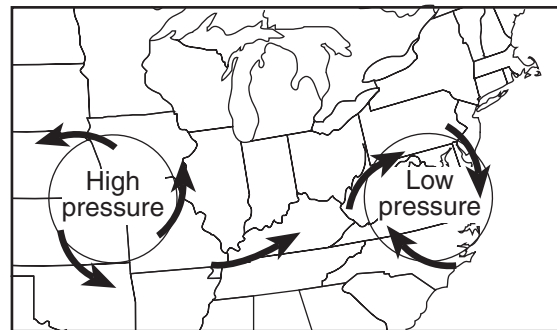
(1)



(3)

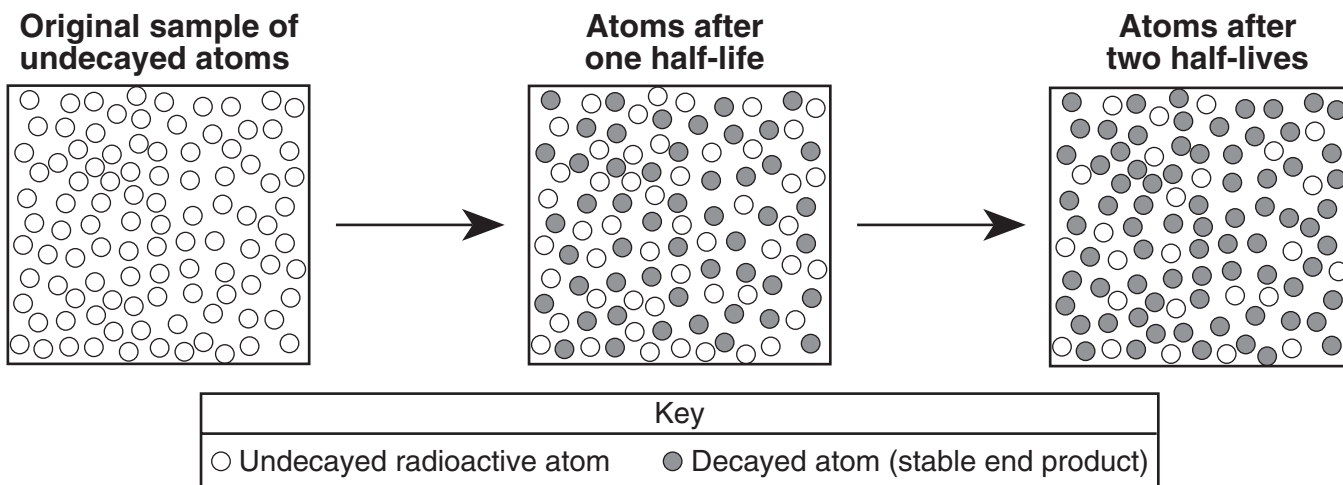


(2)

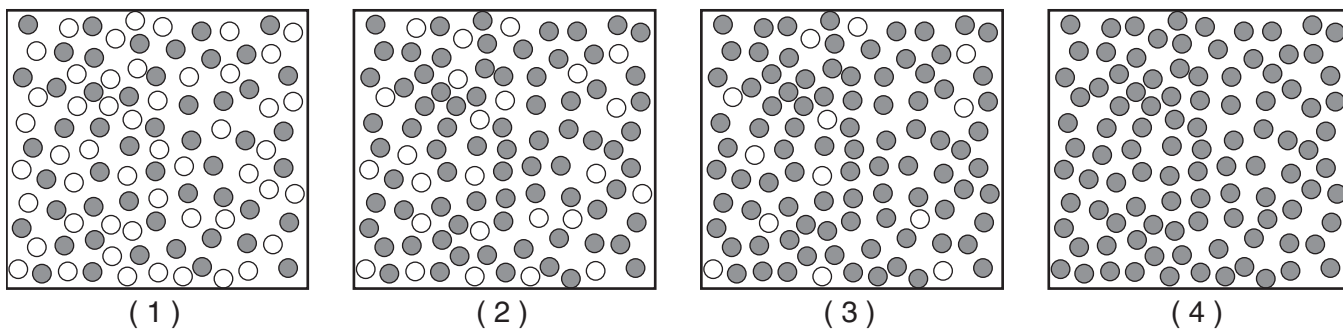


(4)

15 The models below represent the decay of radioactive atoms to stable atoms after their first and second half-lives.



Which model best represents the number of undecayed and decayed atoms after three half-lives?



16 Which sediment size would allow water to flow through at the fastest rate?

- (1) clay (3) sand
- (2) silt (4) pebbles

17 Large oceans moderate the climatic temperatures of surrounding coastal land areas because the temperature of ocean water changes

- (1) rapidly, due to water's low specific heat
- (2) rapidly, due to water's high specific heat
- (3) slowly, due to water's low specific heat
- (4) slowly, due to water's high specific heat

18 The mineral graphite is often used as

- (1) a lubricant
- (2) an abrasive
- (3) a source of iron
- (4) a cementing material

19 In which Earth layer are most convection currents that cause seafloor spreading thought to be located?

- (1) crust (3) outer core
- (2) asthenosphere (4) inner core

20 Which weather map symbol represents air masses that normally form just south of the United States over the Caribbean Sea?

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

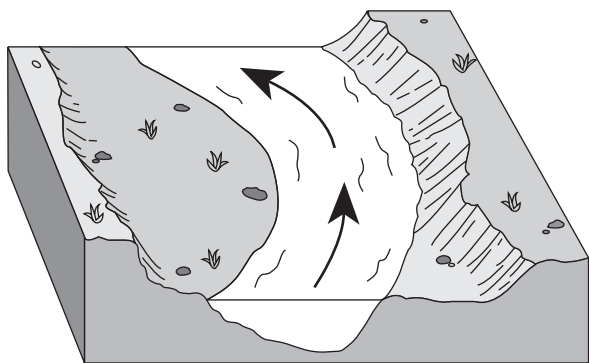
21 An earthquake's magnitude can be determined by

- (1) analyzing the seismic waves recorded by a seismograph
- (2) calculating the depth of the earthquake faulting
- (3) calculating the time the earthquake occurred
- (4) comparing the speed of *P*-waves and *S*-waves

22 A seismic station is recording the seismic waves produced by an earthquake that occurred 4200 kilometers away. Approximately how long after the arrival of the first *P*-wave will the first *S*-wave arrive?

- (1) 1 min 05 sec
- (2) 5 min 50 sec
- (3) 7 min 20 sec
- (4) 13 min 10 sec

23 The diagram below shows a section of a meander in a stream. The arrows show the direction of stream flow.



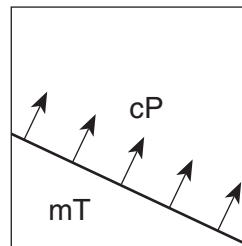
The streambank on the outside of this meander is steeper than the streambank on the inside of this meander because the water on the outside of this meander is moving

- (1) slower, causing deposition
- (2) faster, causing deposition
- (3) slower, causing erosion
- (4) faster, causing erosion

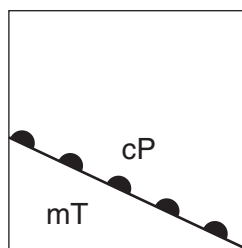
24 Which agent of erosion is mainly responsible for the formation of the depressions occupied by both the kettle lakes and finger lakes found in New York State?

- (1) wind
- (2) waves
- (3) streams
- (4) glaciers

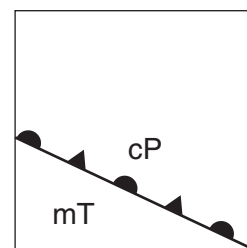
25 The map below shows the boundary between two air masses. The arrows show the direction in which the boundary is moving.



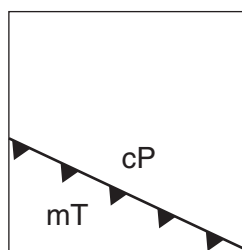
Which weather map uses the correct weather front symbol to illustrate this information?



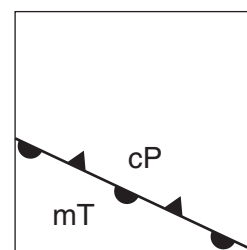
(1)



(3)



(2)

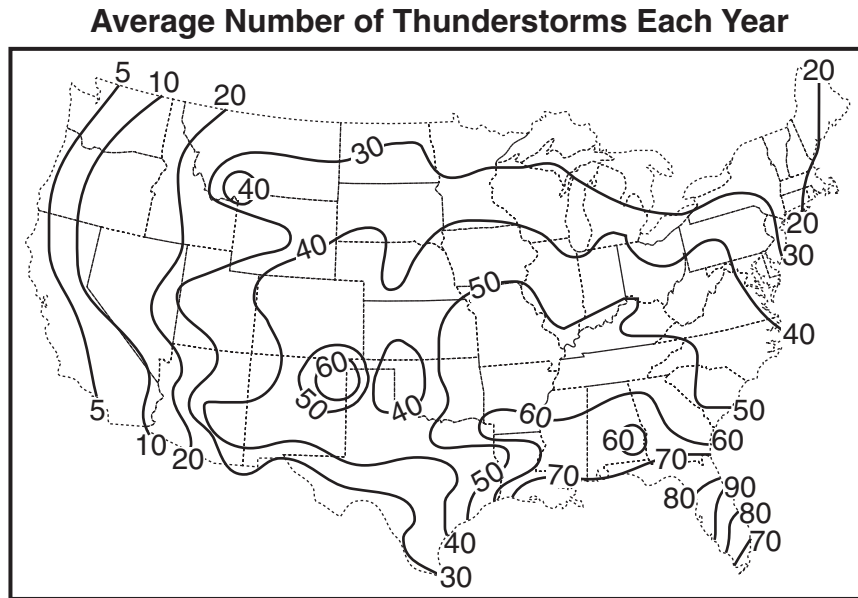


(4)

26 If a low-pressure system follows a typical storm track across New York State, it will move toward the

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

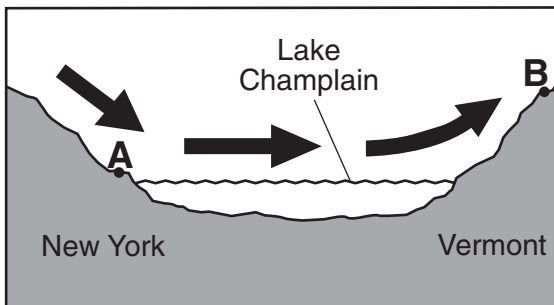
27 The map below shows the average number of thunderstorms during the year in the continental United States.



Which New York State landscape region normally experiences the most thunderstorms?

- | | |
|-----------------------|--------------------------|
| (1) Allegheny Plateau | (3) Adirondack Mountains |
| (2) Taconic Mountains | (4) Champlain Lowlands |

28 The arrows in the cross section below show the prevailing winds moving across northern New York State into Vermont during the summer.

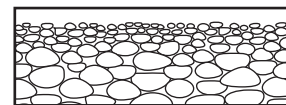


(Not drawn to scale)

Compared to the climate of location A, the climate of location B is

- | | |
|-----------------------|-----------------------|
| (1) warmer and wetter | (3) cooler and wetter |
| (2) warmer and drier | (4) cooler and drier |

29 The cross section below shows a profile of a sediment deposit.

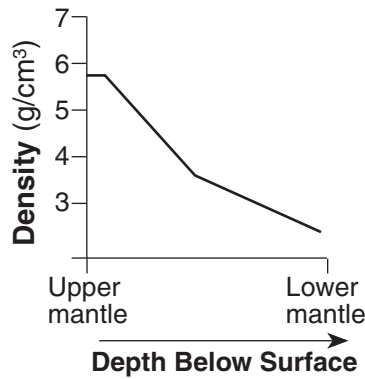


(Drawn to scale)

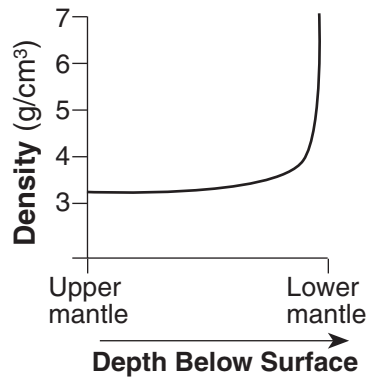
The pattern of sediment size shown indicates that these sediments were most likely deposited within a

- | | |
|---------------|-------------|
| (1) landslide | (3) moraine |
| (2) drumlin | (4) delta |

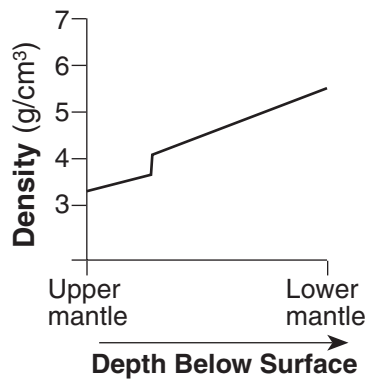
30 Which graph best shows the inferred density of Earth's interior as depth increases from the upper mantle to the lower mantle?



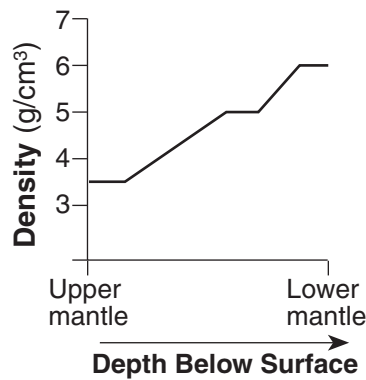
(1)



(3)



(2)



(4)

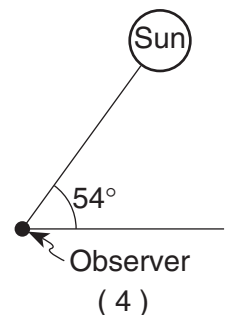
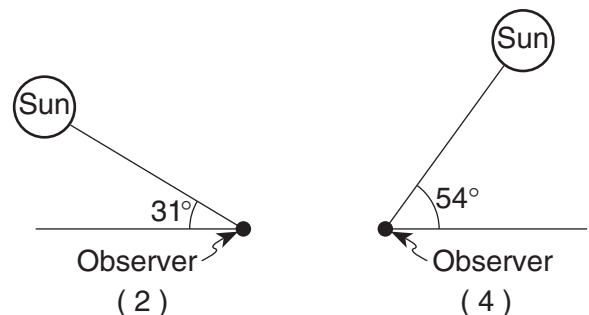
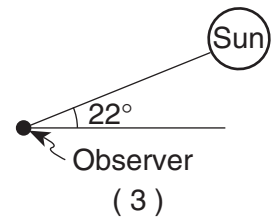
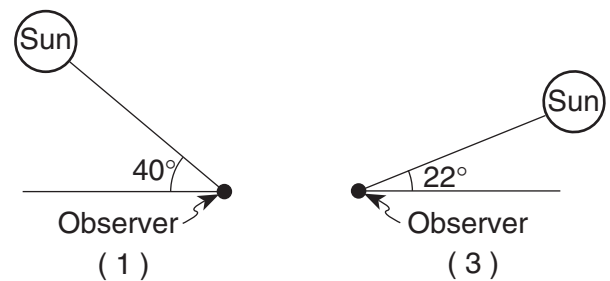
31 The Catskills landscape region is classified as a plateau primarily because the region has

- (1) V-shaped valleys
- (2) jagged hilltops
- (3) horizontal bedrock structure
- (4) folded metamorphic rock

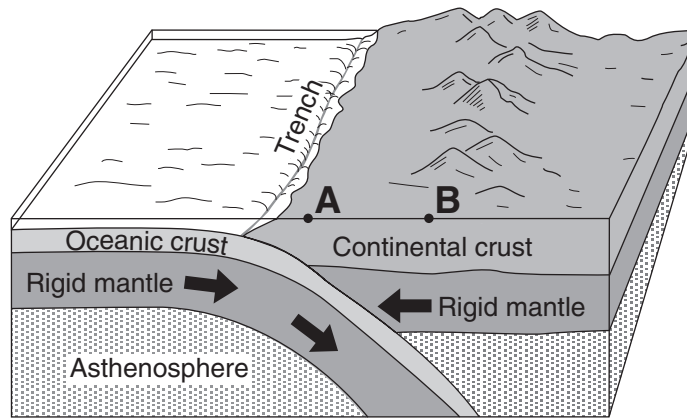
32 London, England, is located at approximately $51^{\circ} 30'$ north latitude and 0° longitude. Elmira, New York, is located at approximately $42^{\circ} 10'$ north latitude and $76^{\circ} 54'$ west longitude. What is one reason why London has a warmer average winter temperature than Elmira?

- (1) London is located closer to the equator.
- (2) London is located at a higher elevation.
- (3) London's climate is modified by the North Atlantic Ocean Current.
- (4) London's climate is modified by its longer duration of insolation.

33 In which diagram is the observer experiencing the greatest intensity of insolation?

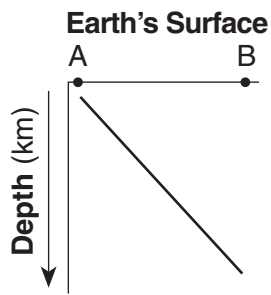


34 The block diagram below shows a tectonic plate boundary. Points A and B represent locations on Earth's surface.

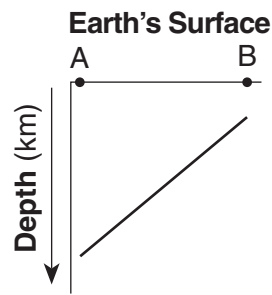


(Not drawn to scale)

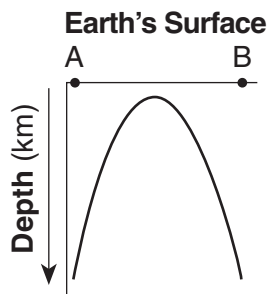
Which graph best shows the depths of most major earthquakes whose epicenters lie between A and B?



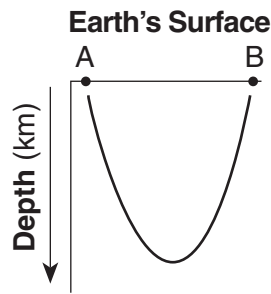
(1)



(3)

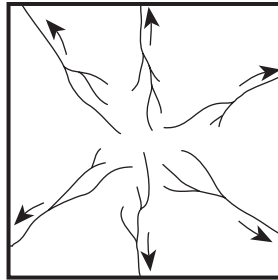


(2)

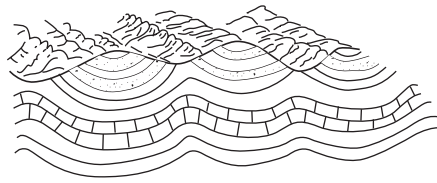


(4)

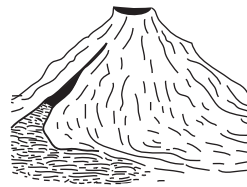
35 The map below shows a stream drainage pattern. Arrows show the direction of stream flow.



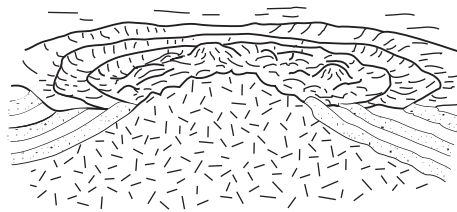
On which landscape region did this drainage pattern most likely develop?



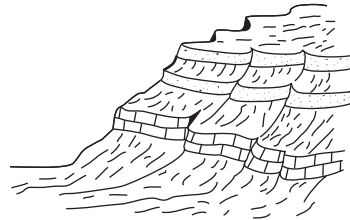
(1)



(3)



(2)



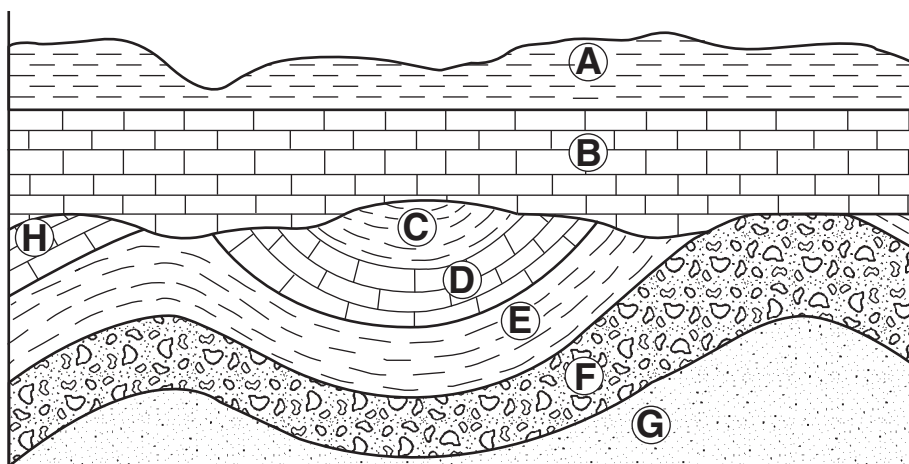
(4)

Part B-1

Answer all questions in this part.

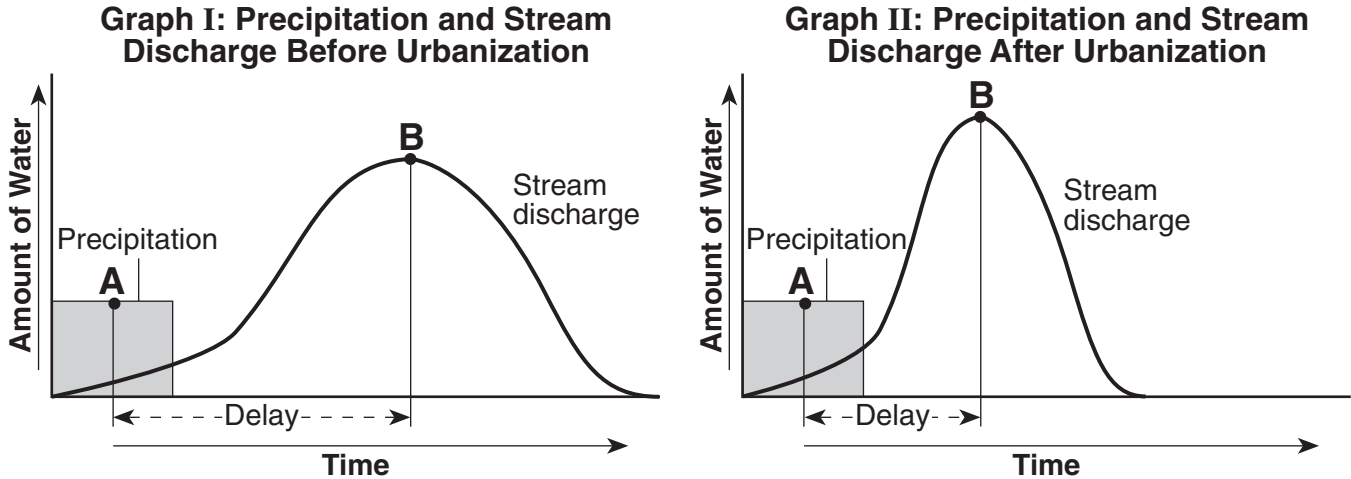
Directions (36–50): For each statement or question, write on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 36 through 38 on the geologic cross section below in which overturning has not occurred. Letters A through H represent rock layers.



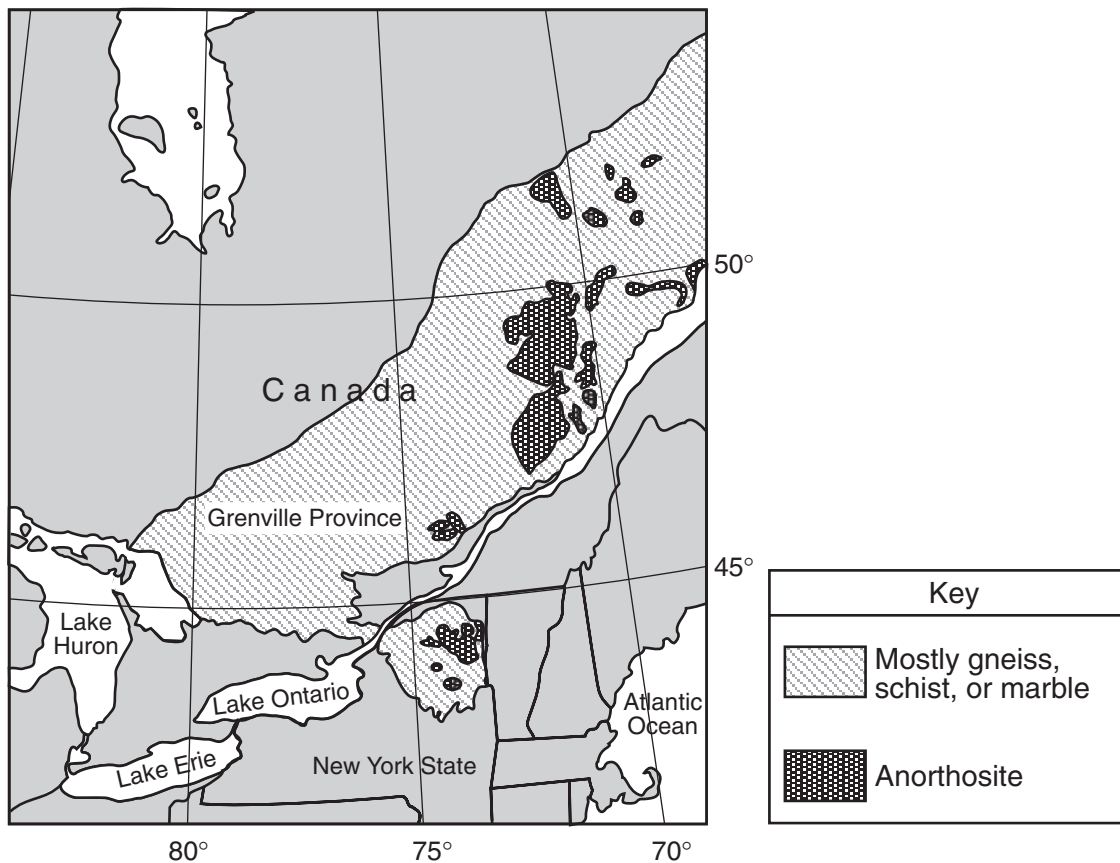
- 36 Which sequence of events most likely caused the unconformity shown at the bottom of rock layer B?
- (1) folding → uplift → erosion → deposition
 - (2) intrusion → erosion → folding → uplift
 - (3) erosion → folding → deposition → intrusion
 - (4) deposition → uplift → erosion → folding
- 37 The folding of rock layers G through C was most likely caused by
- (1) erosion of overlying sediments
 - (2) contact metamorphism
 - (3) the collision of lithospheric plates
 - (4) the extrusion of igneous rock
- 38 Which two letters represent bedrock of the same age?
- (1) A and E
 - (2) B and D
 - (3) F and G
 - (4) D and H
-

Base your answers to questions 39 and 40 on the two graphs below, which show the relationship between the amount of rainfall during a storm and the amount of discharge into a nearby stream. Letter *A* represents the time when approximately 50% of the precipitation from the storm has fallen. Letter *B* represents the time when peak runoff from the storm is flowing into the stream. The delay is the difference in time between letters *A* and *B* on the graph. Graph I shows data before urbanization in an area. Graph II shows data after urbanization in the same area.



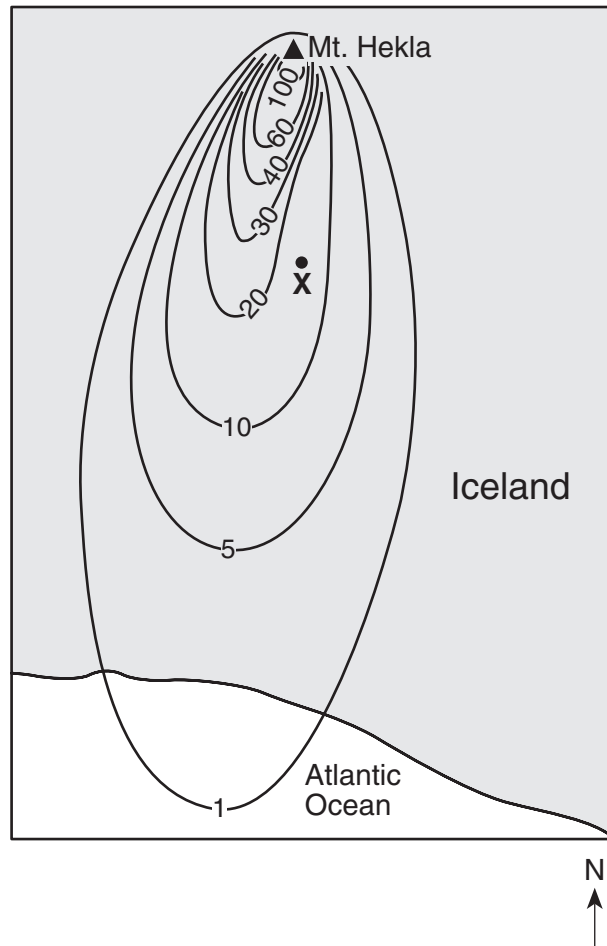
- 39 The delay time between points *A* and *B* on both graphs is due mainly to the time needed for
- (1) groundwater to evaporate
 - (2) precipitation water to move into the streams
 - (3) green plants to absorb precipitation
 - (4) rainfall rate to decrease
- 40 How did urbanization affect delay time between points *A* and *B* and the maximum stream discharge?
- (1) The delay time decreased, and the maximum discharge decreased.
 - (2) The delay time decreased, and the maximum discharge increased.
 - (3) The delay time increased, and the maximum discharge decreased.
 - (4) The delay time increased, and the maximum discharge increased.
-

Base your answers to questions 41 through 43 on the map below. The map shows some regions where metamorphic bedrock of the Grenville Province in northeastern North America is exposed at Earth's surface.



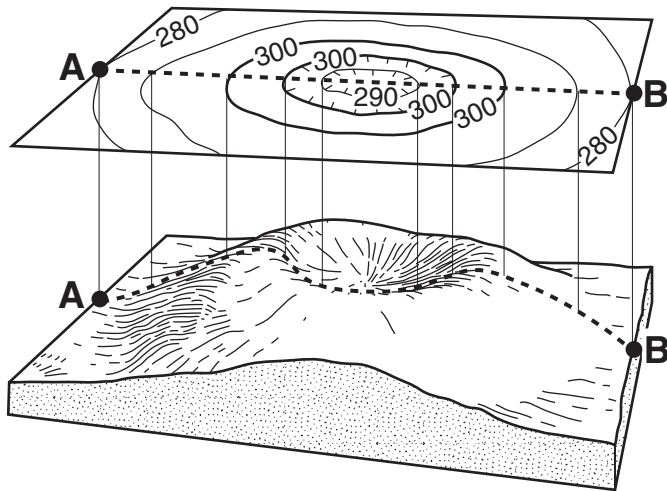
- 41 The bedrock of the Grenville Province is generally thought to have formed approximately
- | | |
|---------------------------|----------------------------|
| (1) 250 million years ago | (3) 560 million years ago |
| (2) 400 million years ago | (4) 1100 million years ago |
- 42 Which New York State location has surface bedrock that consists mainly of anorthositic rock?
- | | |
|---------------|---------------|
| (1) Old Forge | (3) Mt. Marcy |
| (2) Massena | (4) Utica |
- 43 Which location has surface bedrock that consists mostly of gneiss, schist, or marble?
- | | |
|-----------------|-----------------|
| (1) 43° N 81° W | (3) 47° N 69° W |
| (2) 46° N 78° W | (4) 49° N 71° W |

Base your answers to questions 44 through 46 on the map below. The ▲ represents Mt. Hekla, a volcano in Iceland. The isolines represent the thickness of ash, in centimeters, that settled on Earth's surface after a volcanic eruption of Mt. Hekla on March 29, 1947. Point X is a location on the surface of the ash.

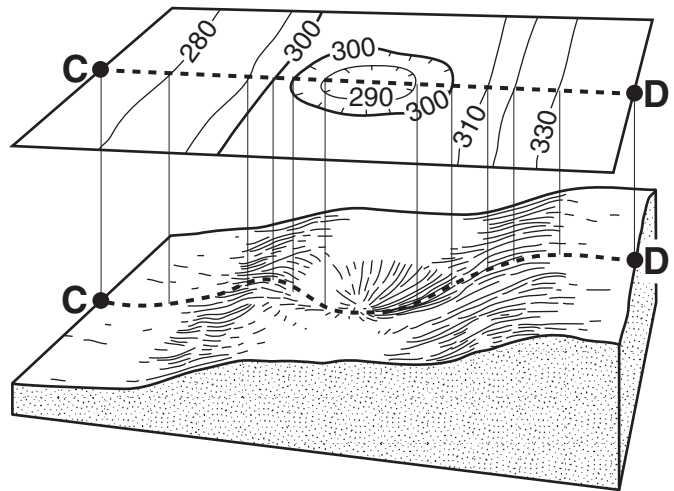


- 44 At the time of the eruption, the wind direction was primarily from the
- | | |
|----------|-----------|
| (1) east | (3) north |
| (2) west | (4) south |
- 45 How many centimeters thick was the ash beneath point X?
- | | |
|--------|--------|
| (1) 0 | (3) 20 |
| (2) 15 | (4) 25 |
- 46 In addition to the ash, solid rock formed on Mt. Hekla from the lava extruded during this eruption. This rock is most likely
- | | |
|-------------------------------|----------------------------|
| (1) light-colored metamorphic | (3) fine-grained igneous |
| (2) dark-colored metamorphic | (4) coarse-grained igneous |

Base your answers to questions 47 and 48 on the topographic maps and block diagrams of two landscape regions shown below. The block diagrams show a three-dimensional view of the topographic maps directly above them. Elevations are measured in feet. Points A, B, C, and D are locations on Earth's surface.



Landscape 1

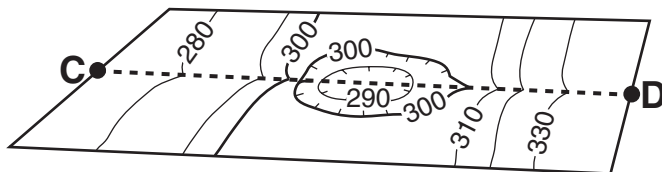


Landscape 2

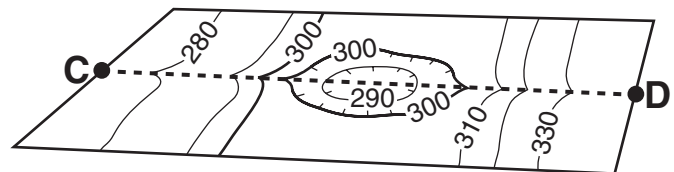
47 Which contour interval is used on both topographic maps?

- (1) 10 ft
- (2) 20 ft
- (3) 30 ft
- (4) 40 ft

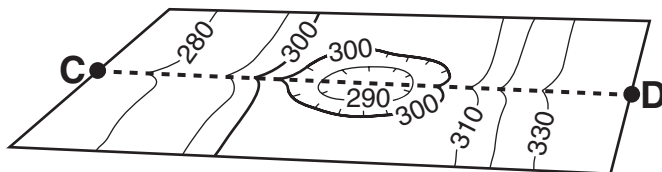
48 A stream begins to flow downhill from point D toward the depression. After a period of time, the depression fills with water. Overflowing water from the depression moves downhill toward point C. Which topographic map shows the most likely resulting change in the contour lines?



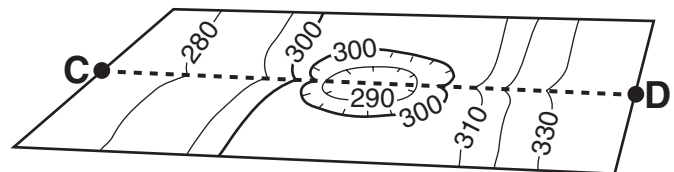
(1)



(3)

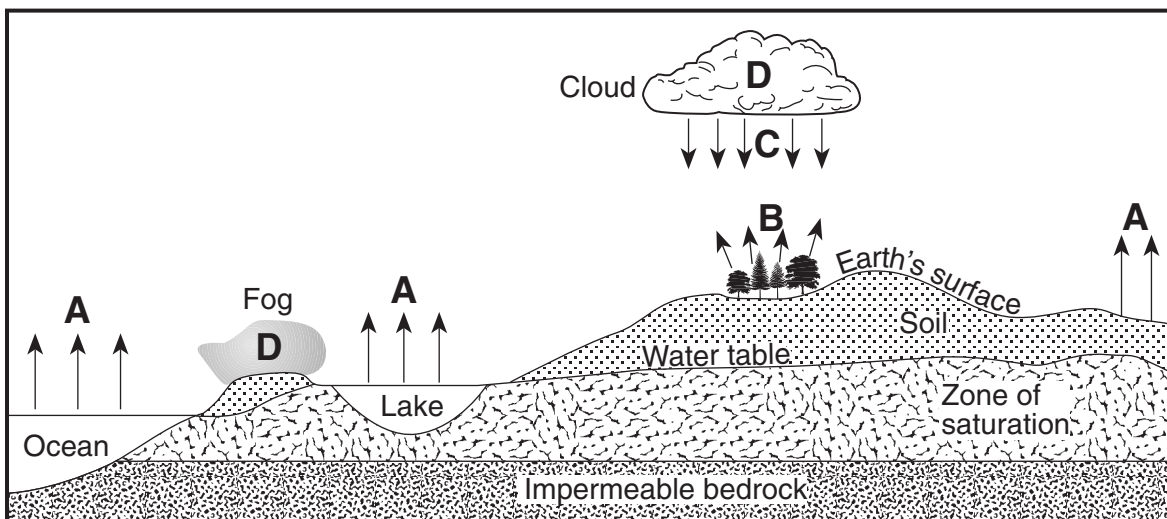


(2)



(4)

Base your answers to questions 49 and 50 on the cross section below, which represents part of Earth's water cycle. Letters *A*, *B*, *C*, and *D* represent processes that occur during the cycle. The level of the water table and the extent of the zone of saturation are shown.



49 Which two letters represent processes in the water cycle that usually cause a lowering of the water table?

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

50 What are two water cycle processes *not* represented by arrows in this cross section?

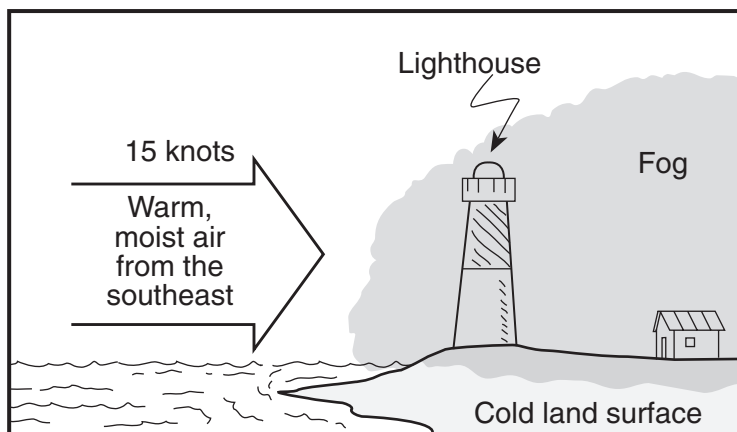
- (1) transpiration and condensation
- (2) evaporation and melting
- (3) precipitation and freezing
- (4) runoff and infiltration

Part B-2

Answer all questions in this part.

Directions (51–63): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Earth Science Reference Tables*.

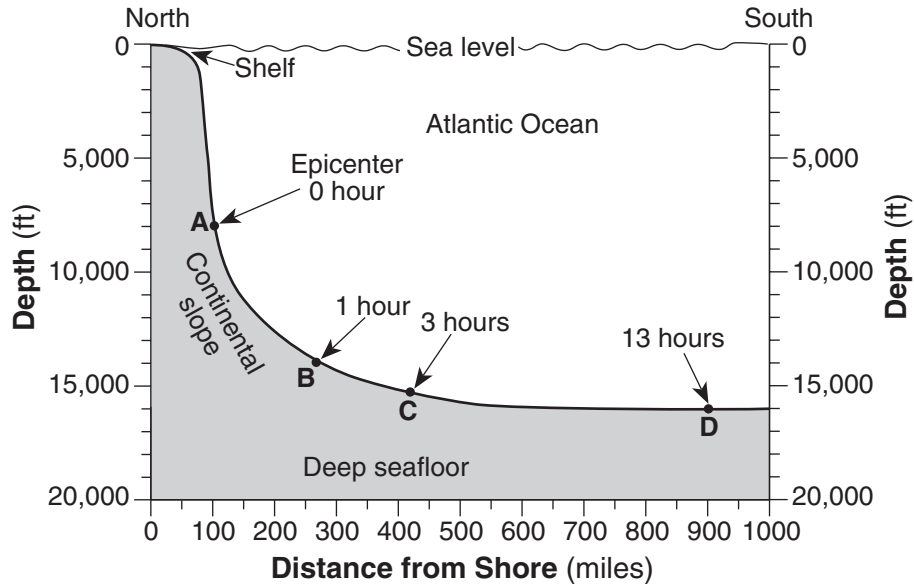
51 The diagram below shows conditions that commonly cause fog to form over land in coastal areas.



A weather station at the lighthouse records a temperature of 36°F and an air pressure of 1016.4 mb. Using the proper weather map symbols, place the following information in the correct positions on the weather station model *in your answer booklet*. [2]

- Present weather
- Dewpoint
- Air pressure
- Wind direction
- Wind speed

Base your answers to questions 52 and 53 on the cross section below, which represents part of the Atlantic Ocean seafloor. An earthquake occurred on November 18, 1929, triggering an underwater sediment flow. The location of the epicenter is labeled. Letters A through D indicate locations on the seafloor. Time, in hours, at each lettered location represents the arrival of the sediment flow after the earthquake.



- 52 Calculate the gradient of the ocean floor between locations A and D and label your answer with the correct units. [2]
- 53 Explain why the velocity of the sediment flow created by the earthquake *decreased* as the sediment moved from location B to location C. [1]

Base your answers to questions 54 through 56 on the data table below, which shows some characteristics of four rock samples, numbered 1 through 4. Some information has been left blank. All answers must be recorded in your answer booklet.

Data Table

Rock Sample Number	Composition	Grain Size	Texture	Rock Name
1	mostly clay minerals		clastic	shale
2	all mica	microscopic, fine	foliated with mineral alignment	
3	mica, quartz, feldspar, amphibole, garnet, pyroxene	medium to coarse	foliated with banding	gneiss
4	potassium feldspar, quartz, biotite, plagioclase feldspar, amphibole	5 mm		granite

54 State a possible grain size, in centimeters, for most of the particles found in sample 1. [1]

55 Write the rock name of sample 2. [1]

56 Write a term or phrase that correctly describes the texture of sample 4. [1]

Base your answers to questions 57 through 60 on the diagram in your answer booklet, which shows Earth as seen from above the North Pole. The curved arrows show the direction of Earth's motion. The shaded portion represents the nighttime side of Earth. Some of the latitude and longitude lines have been labeled. Points A and B represent locations on Earth's surface.

57 On the diagram *in your answer booklet*, draw a curved arrow, starting at point B, showing the general direction that planetary surface winds flow between 30° N and 60° N latitude. [1]

58 If it is 4:00 p.m. at point B, what is the time at point A? [1]

59 Identify *one* possible date that is represented by the diagram. [1]

60 Explain why the angle of insolation at solar noon is greater at point B than at point A. [1]

Base your answers to questions 61 through 63 on the cross section in your answer booklet. The cross section shows a portion of Earth's crust. Letters *A*, *B*, *C*, and *D* represent rock units that have not been overturned.

- 61 On the cross section *in your answer booklet*, place an **X** where the metamorphic rock quartzite may be found. [1]
- 62 Identify by name the most abundant mineral in rock unit *A*. [1]
- 63 State *one* piece of evidence shown in the cross section that indicates that rock unit *D* is older than igneous intrusion *C*. [1]
-

Part C

Answer all questions in this part.

Directions (64–82): 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 64 and 65 on the data table below, which shows the azimuths of sunrise and sunset on August 2 observed at four different latitudes. Azimuth is the compass direction measured, in degrees, along the horizon, starting from north.

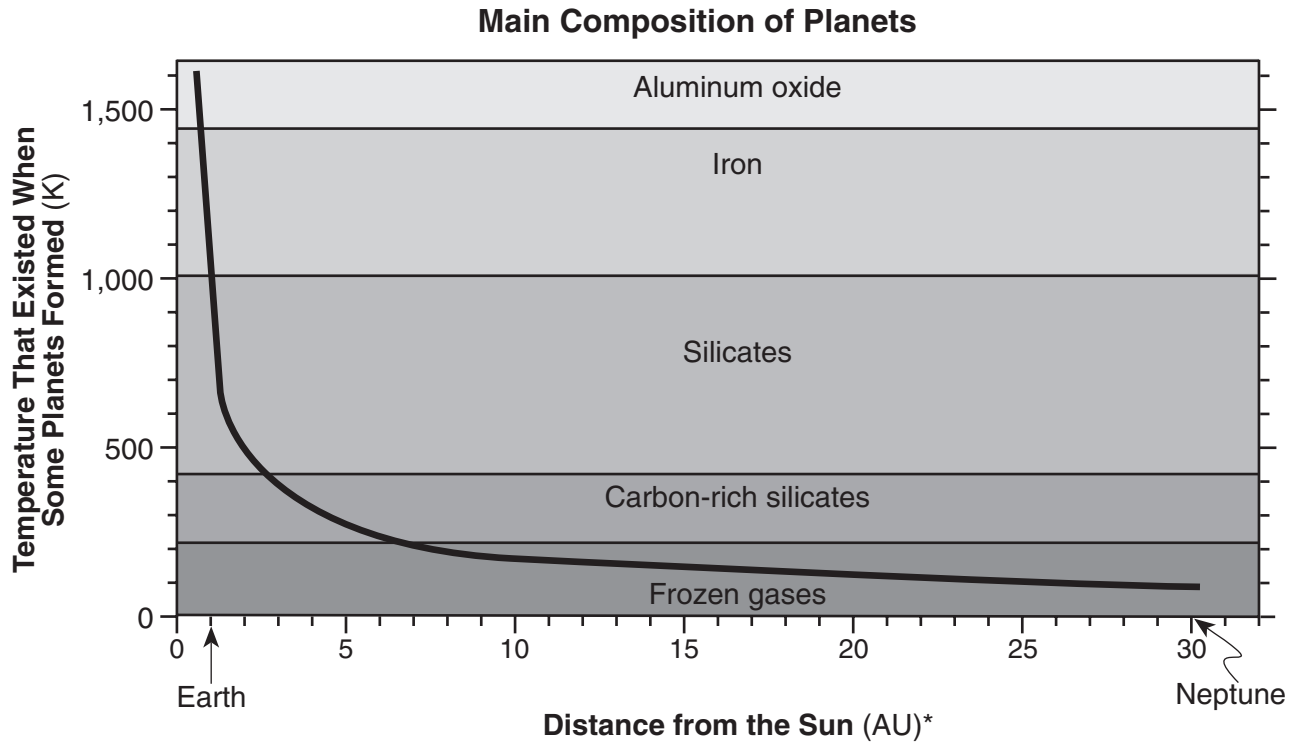
Data Table

Latitude	Azimuths of Sunrise and Sunset	Letter Code
30° N	sunrise 69°	A
	sunset 291°	B
40° N	sunrise 66°	C
	sunset 294°	D
50° N	sunrise 61°	E
	sunset 299°	F
60° N	sunrise 51°	G
	sunset 309°	H

64 On the outer edge of the azimuth circle *in your answer booklet*, mark with an **X** the positions of sunrise and sunset for *each* latitude shown in the data table. Write the correct letter code beside each **X**. The positions of sunrise and sunset for 30° N have been plotted and labeled with letters *A* and *B*. [2]

65 State the relationship at *sunrise* between the latitude and the azimuth. [1]

Base your answers to questions 66 through 69 on the graph below, which shows two conditions responsible for the formation and composition of some planets in our solar system. The distances of Earth and Neptune from the Sun, in astronomical units (AU), are shown beneath the horizontal axis. (1 AU = 149.6 million kilometers). The plotted line on this graph shows the relationship between a planet's distance from the Sun and the inferred temperature at its formation. The regions within the graph indicate the composition of planets formed within these zones.

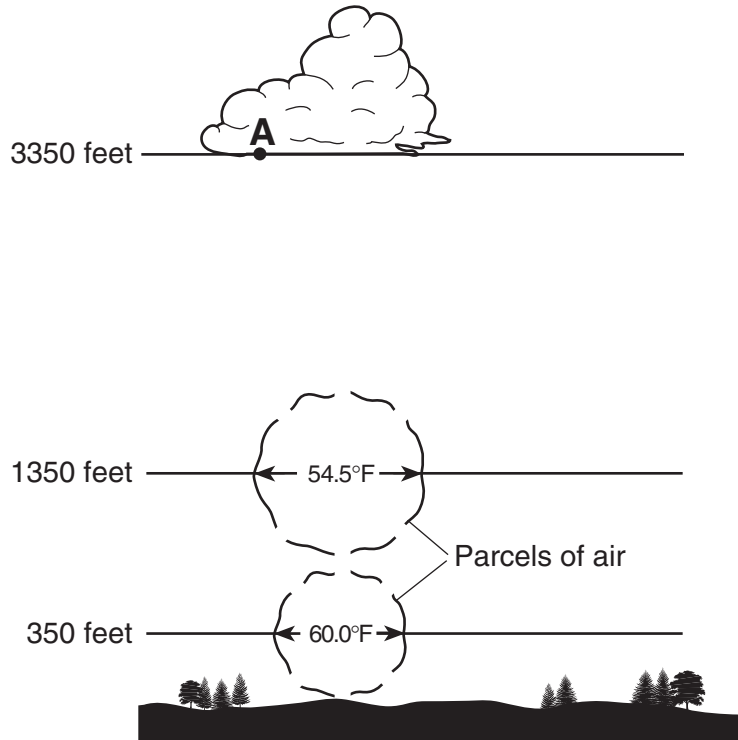


* 1 AU equals the average distance from Earth to the Sun or 149.6 million kilometers.

- 66 According to the graph, Neptune was mainly composed of which material at the time of its formation? [1]
- 67 Saturn is located 9.5 AU from the Sun. State the approximate temperature at which Saturn formed. [1]
- 68 State the relationship between a planet's distance from the Sun and the temperature at which that planet formed. [1]
- 69 What is Jupiter's distance from the Sun, in astronomical units? Express your answer to the *nearest tenth*. [1]

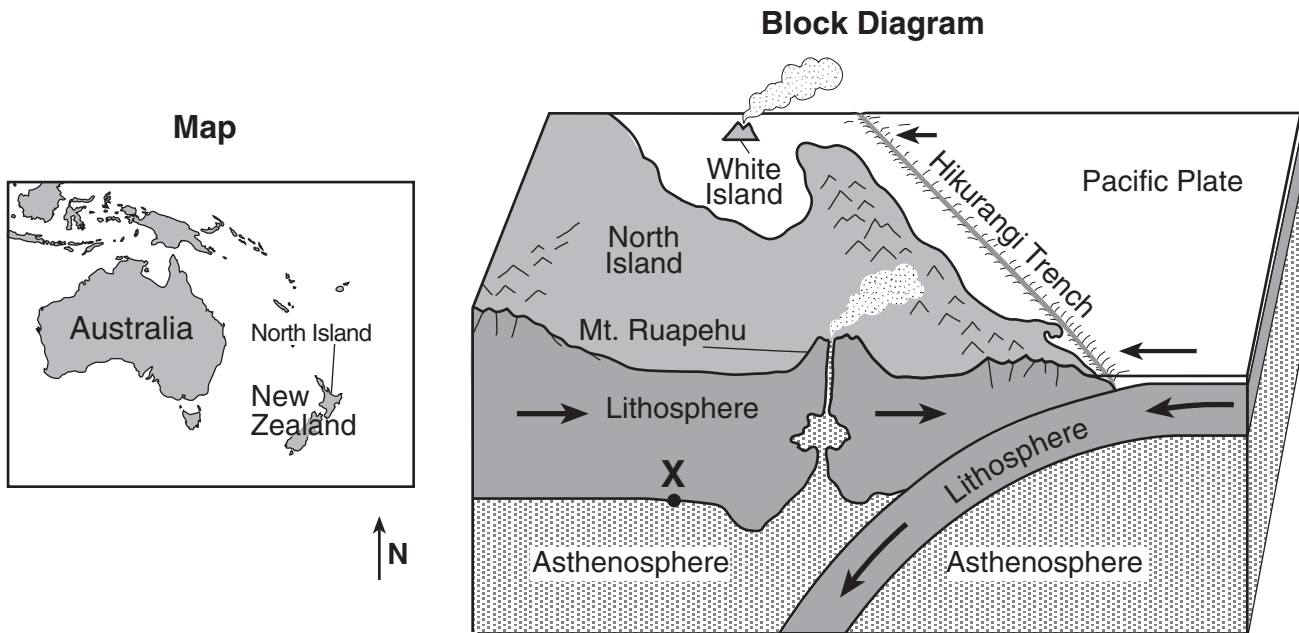
Base your answers to questions 70 through 72 on the diagram below, which shows the temperature change when a parcel of air warms, rises, and expands to form a cloud. Location A is at the base of the cloud.

Cloud Formation



- 70 Explain why the warmer air rises. [1]
- 71 Assume the cooling rate of the rising parcel of air is constant. Determine the temperature of the air parcel at the 3350-foot altitude. Express your answer to the *nearest tenth of a degree*. [1]
- 72 State the relative humidity of the air at location A. [1]
-

Base your answers to questions 73 through 76 on the map and block diagram below. The map shows the location of North Island in New Zealand. The block diagram shows a portion of North Island. The Hikurangi Trench is shown forming at the edge of the Pacific Plate. Point X is at the boundary between the lithosphere and the asthenosphere.



(Not drawn to scale)

- 73 State the approximate temperature at point X. [1]
- 74 On what tectonic plate are both North Island and White Island located? [1]
- 75 Describe the type of tectonic plate motion that formed the Hikurangi Trench. [1]
- 76 Describe *one* action that people on North Island should take if a tsunami warning is issued. [1]

Base your answers to questions 77 through 79 on the data table below and on your knowledge of Earth science. The data table shows the average monthly discharge, in cubic feet per second, for a stream in New York State.

Data Table

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Discharge (ft ³ /sec)	48	52	59	66	62	70	72	59	55	42	47	53

- 77 On the grid in your answer booklet, plot with an **X** the average stream discharge for each month shown in the data table. Connect the **X**s with a line. [1]
- 78 State the relationship between this stream's discharge and the amount of suspended sediment that can be carried by this stream. [1]
- 79 Explain *one* possible reason why this stream's discharge in April is usually greater than this stream's discharge in January. [1]
-

Base your answers to questions 80 through 82 on the passage below and on your knowledge of Earth science.

Ozone in Earth's Atmosphere

Ozone is a special form of oxygen. Unlike the oxygen we breathe, which is composed of two atoms of oxygen, ozone is composed of three atoms of oxygen. A concentrated ozone layer between 10 and 30 miles above Earth's surface absorbs some of the harmful ultraviolet radiation coming from the Sun. The amount of ultraviolet light reaching Earth's surface is directly related to the angle of incoming solar radiation. The greater the Sun's angle of insolation, the greater the amount of ultraviolet light that reaches Earth's surface. If the ozone layer were completely destroyed, the ultraviolet light reaching Earth's surface would most likely increase human health problems, such as skin cancer and eye damage.

- 80 State the name of the temperature zone of Earth's atmosphere where the concentrated layer of ozone gas exists. [1]
- 81 Explain how the concentrated ozone layer above Earth's surface is beneficial to humans. [1]
- 82 Assuming clear atmospheric conditions, on what day of the year do people in New York State most likely receive the most ultraviolet radiation from the Sun? [1]
-

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Wednesday, January 24, 2007 — 9:15 a.m. to 12:15 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

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Tear Here

Tear Here