The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Thursday, August 13, 2009 — 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 (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*.

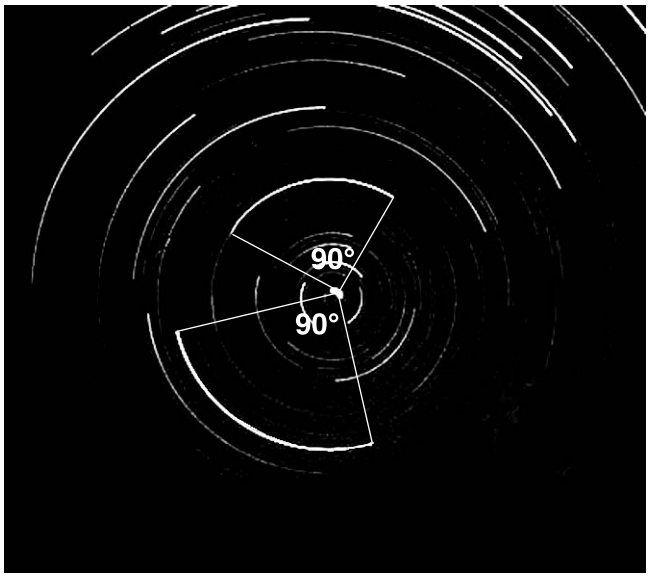
1 An observer recorded the times of three successive high tides at one Earth location as:

- 7:12 a.m.
- 7:38 p.m.
- 8:04 a.m.

What was the time of the next high tide?

(1) 8:12 p.m. (3) 8:38 p.m.
(2) 8:30 p.m. (4) 9:04 p.m.

2 A camera was placed in an open field and pointed toward the northern sky. The lens of the camera was left open for a certain amount of time. The result is shown in the photograph below. The angle of the arc through which two of the stars appeared to move during this time exposure is shown.



How many hours was the lens left open to produce the photograph?

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

3 At which location is the altitude of *Polaris* approximately 42°?

(1) Niagara Falls (3) Watertown
(2) Elmira (4) Massena

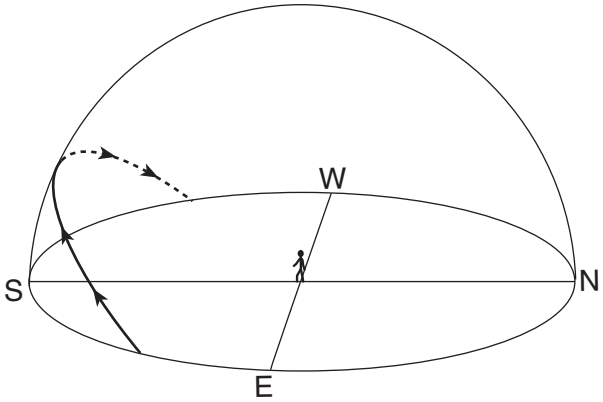
4 At which latitude is the Sun directly overhead on certain days of the year?

(1) 23.5° N (3) 66.5° N
(2) 42° N (4) 90° N

5 Which motion causes the constellation Orion to be visible at midnight from New York State in winter but not in summer?

(1) rotation of Earth
(2) rotation of Orion
(3) revolution of Earth
(4) revolution of Orion

6 The model below shows the Sun's apparent path across the sky for an observer in New York State.



On which day of the year was this path observed?

(1) March 21 (3) September 21
(2) June 21 (4) December 21

7 What does a red shift in light from distant celestial objects indicate to a scientist on Earth?

(1) The gravitational force on Earth changes.
(2) The universe appears to be expanding.
(3) The Jovian planets are aligned with the Sun.
(4) Galaxies are becoming more numerous.

8 During a heavy rainstorm, runoff is most likely to occur if the surface soil is

(1) firmly packed clay-sized particles
(2) loosely packed sand-sized particles
(3) covered by trees, shrubs, and grasses
(4) unsaturated and has a gentle slope

9 By which process do plants add water vapor to the atmosphere?

(1) precipitation
(2) transpiration
(3) condensation
(4) absorption

10 Cloud formation is likely to occur in rising air because rising air

(1) expands and cools
(2) expands and warms
(3) contracts and cools
(4) contracts and warms

11 In which two temperature zones of the atmosphere does the temperature increase with increasing altitude?

(1) troposphere and stratosphere
(2) troposphere and mesosphere
(3) stratosphere and thermosphere
(4) mesosphere and thermosphere

12 Which type of electromagnetic radiation has the longest wavelength?

(1) ultraviolet
(2) gamma rays
(3) visible light
(4) radio waves

13 Which cold ocean current affects the climate of the northeastern coast of North America?

(1) Gulf Stream
(2) Canaries
(3) Labrador
(4) North Atlantic

14 Which change would cause a *decrease* in the amount of insolation absorbed at Earth's surface?

(1) a decrease in cloud cover
(2) a decrease in atmospheric transparency
(3) an increase in the duration of daylight
(4) an increase in nitrogen gas

15 Most sandstone bedrock is composed of sediment that was

(1) sorted by size and not layered
(2) sorted by size and layered
(3) unsorted and not layered
(4) unsorted and layered

16 Which event temporarily slows or reverses surface ocean currents in the equatorial region of the Pacific Ocean, causing a disruption of normal weather patterns?

(1) tsunami
(2) volcanic eruption
(3) El Niño
(4) deforestation

17 Increasing the amount of carbon dioxide in Earth's atmosphere increases atmospheric temperature because the carbon dioxide absorbs

(1) incoming solar gamma ray radiation
(2) incoming solar visible light radiation
(3) outgoing terrestrial ultraviolet radiation
(4) outgoing terrestrial infrared radiation

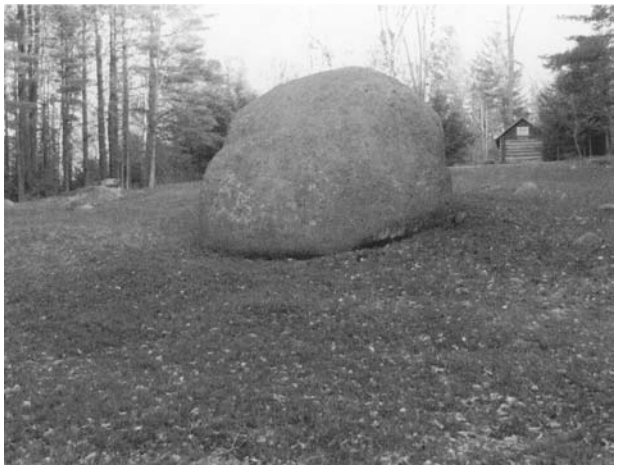
18 The basaltic bedrock of the oceanic crust is classified as

(1) felsic, with a density of 2.7 g/cm^3
(2) felsic, with a density of 3.0 g/cm^3
(3) mafic, with a density of 2.7 g/cm^3
(4) mafic, with a density of 3.0 g/cm^3

19 At which plate boundary is one lithospheric plate sliding under another?

(1) Nazca Plate and Antarctic Plate
(2) Pacific Plate and Indian-Australian Plate
(3) Indian-Australian Plate and Antarctic Plate
(4) Nazca Plate and Pacific Plate

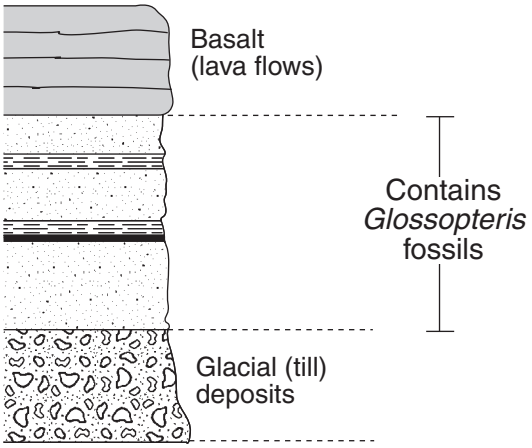
20 The photograph below shows a large boulder of metamorphic rock in a field in the Allegheny Plateau region of New York State.



The boulder was most likely moved to this location by

(1) glacial ice
(2) prevailing wind
(3) streamflow
(4) volcanic action

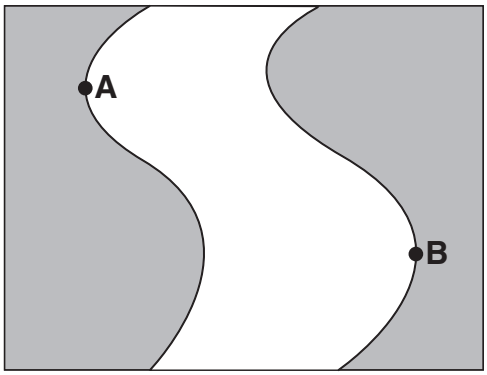
21 The cross section below shows a rock sequence that has not been overturned.



Which event occurred last at this location?

(1) Shale was deposited.
(2) Glacial till was deposited.
(3) Basaltic lava flows solidified.
(4) *Glossopteris* flourished and then became extinct.

22 The map below shows a meandering river. Points *A* and *B* are locations on the banks of the river.



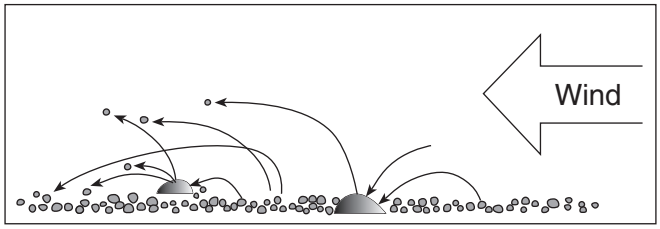
What are the dominant processes occurring at locations *A* and *B*?

(1) deposition at location *A*; erosion at location *B*
(2) erosion at location *A*; deposition at location *B*
(3) deposition at both locations *A* and *B*
(4) erosion at both locations *A* and *B*

23 Which event in Earth's history was dependent on the development of a certain type of life-form?

(1) addition of free oxygen to Earth's atmosphere
(2) formation of clastic sedimentary rocks
(3) movement of tectonic plates
(4) filling of the oceans by precipitation

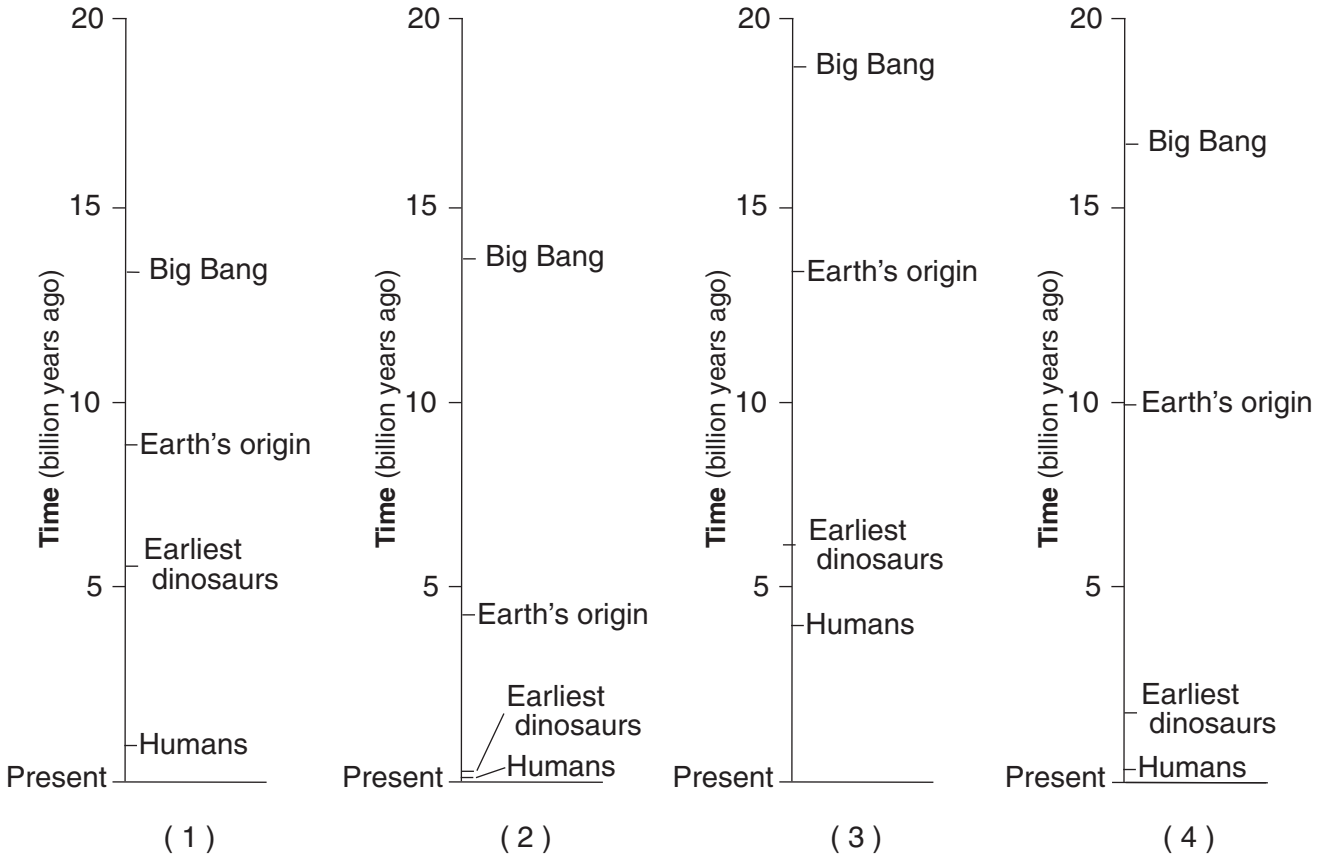
24 The diagram below shows sand particles being moved by wind.



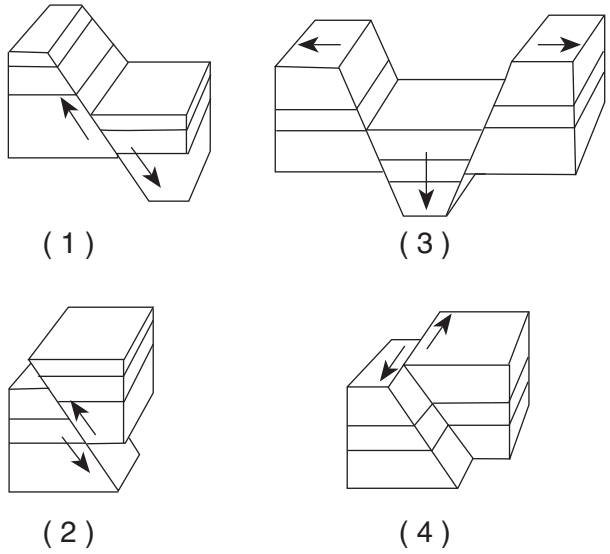
At which Earth surface locations is this process usually the most dominant type of erosion?

(1) deserts and beaches
(2) deltas and floodplains
(3) glaciers and moraines
(4) mountain peaks and escarpments

25 Which time line most accurately indicates when this sequence of events in Earth's history occurred?



26 Which block diagram best shows a transform fault?



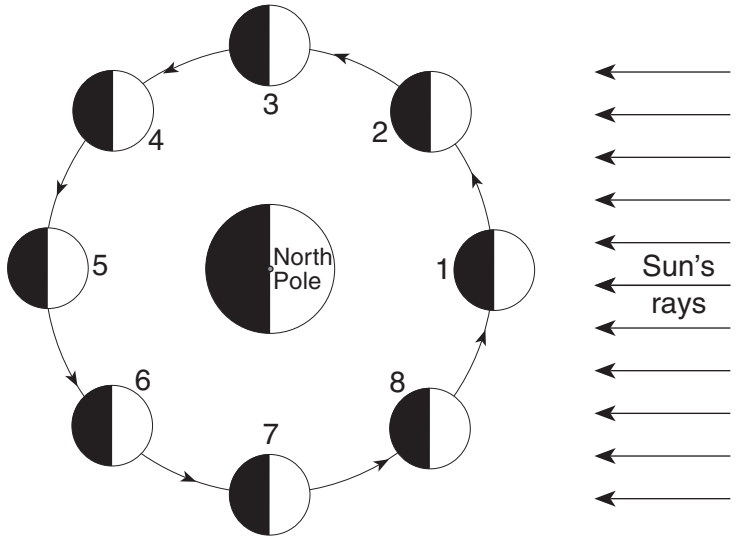
27 Which property is most useful in distinguishing pyroxene from amphibole?

(1) sample size
(2) hardness
(3) type of luster
(4) angles of cleavage

28 Earth's inner core is inferred to be solid based on the analysis of

(1) seismic waves
(2) crustal rocks
(3) radioactive decay rates
(4) magnetic pole reversals

29 The diagram below shows the Moon as it revolves around Earth. The numbered locations represent different positions of the Moon in its orbit.

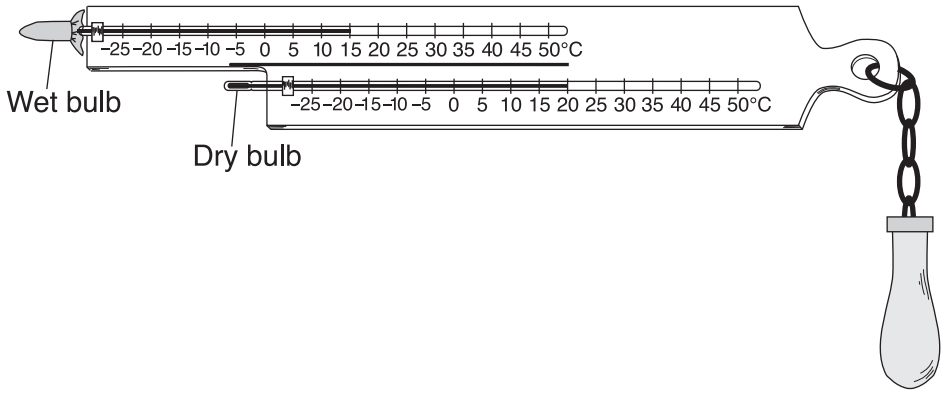


(Not drawn to scale)

Which Moon phase would be seen by an observer in New York State when the Moon is at position 2?

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

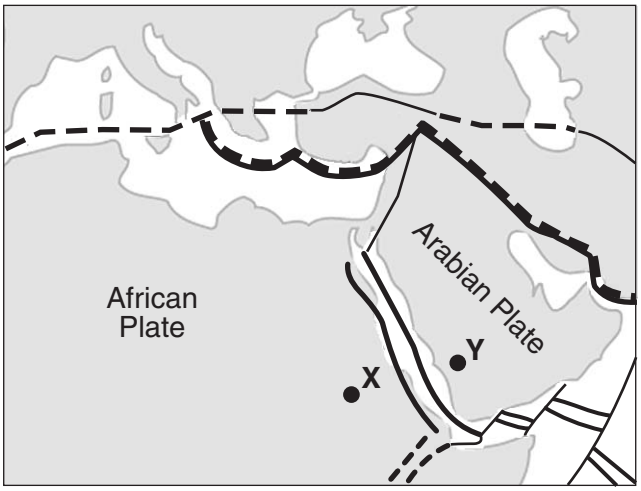
30 The diagram below shows a sling psychrometer.



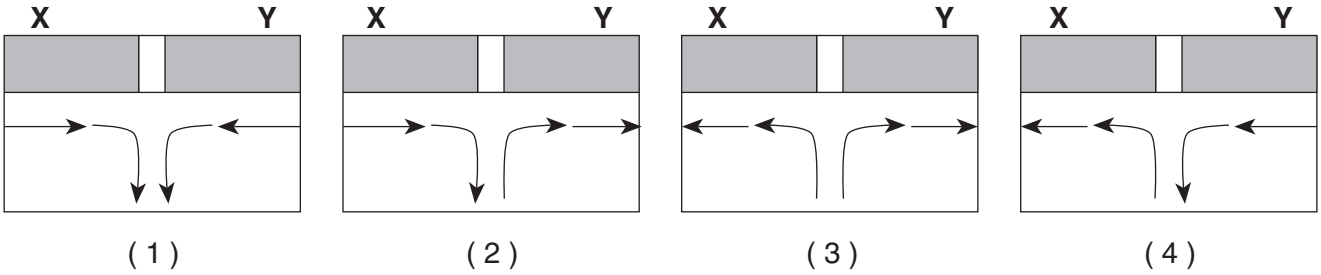
Based on the dry-bulb temperature and the wet-bulb temperature, what is the dewpoint?

(1) 5°C
(2) 12°C
(3) 14°C
(4) 16°C

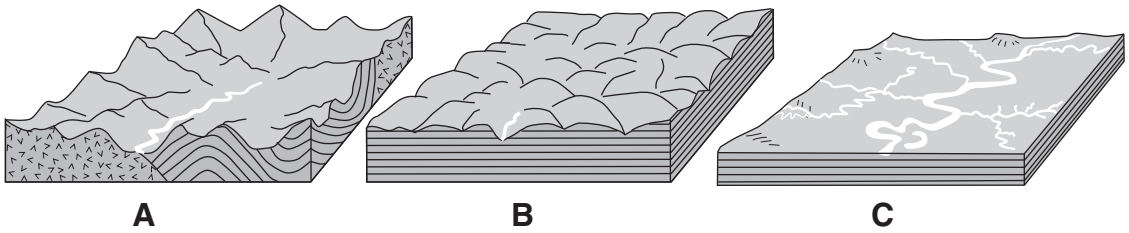
31 The map below shows a portion of Earth's surface. Points *X* and *Y* are locations on the lithosphere.



Which cross section shows the inferred movement of material in the asthenosphere beneath points *X* and *Y*?



32 The block diagrams below, labeled *A*, *B*, and *C*, show the relative elevation and rock structure of three different landscape regions.



Which set correctly identifies the landscape region shown in each block diagram?

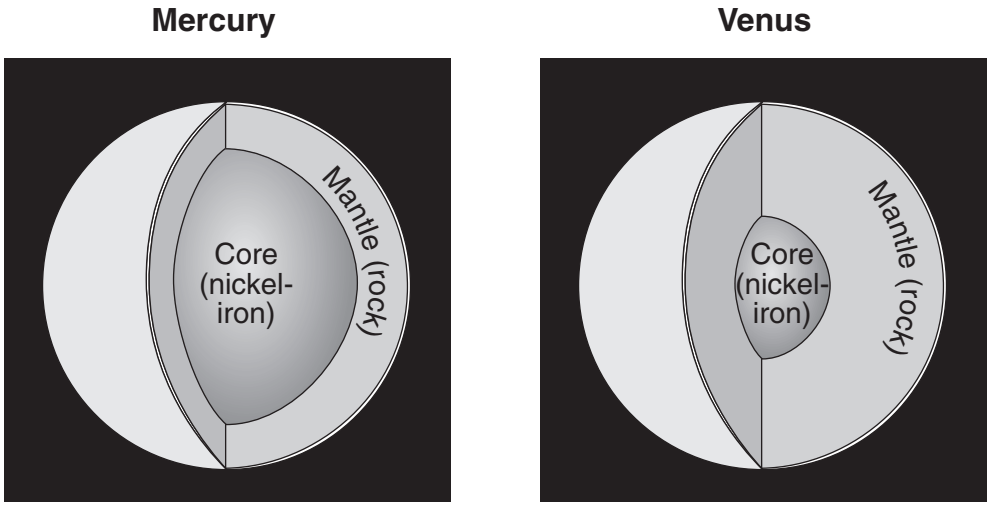
(1) *A*–mountain, *B*–plateau, *C*–plain
(2) *A*–mountain, *B*–plain, *C*–plateau
(3) *A*–plateau, *B*–mountain, *C*–plain
(4) *A*–plateau, *B*–plain, *C*–mountain

33 The photographs below show the surface of the Moon as seen from Earth over an 80-minute period during a single night.

Which motion is responsible for this changing appearance of the Moon?

(1) The Moon moves into the shadow of Earth.
(2) The Moon moves into the shadow of the Sun.
(3) The Sun moves into the shadow of Earth.
(4) The Sun moves into the shadow of the Moon.

34 The diagram below shows cutaway views of the inferred interior layers of the planets Mercury and Venus.

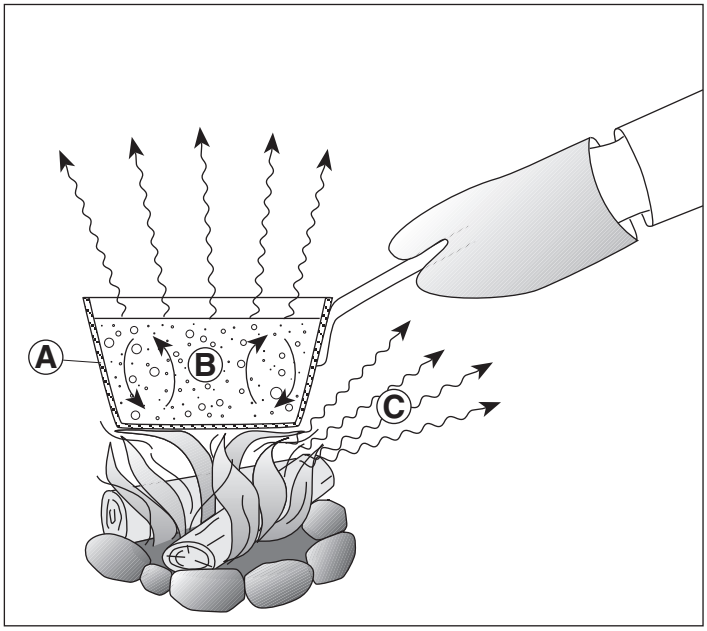


(Not drawn to scale)

What is the reason for the development of the interior layers of these two planets?

(1) Impact events added the mantle rock above the cores.
(2) Heat from the Sun melted the surface rocks to form the mantles above the cores.
(3) Gravity separated the cores and mantles due to their density differences.
(4) Rapid heat loss caused the cores to solidify before the mantles.

35 The diagram below shows a student heating a pot of water over a fire. The arrows represent the transfer of heat. Letter *A* represents heat transfer through the metal pot, *B* represents heat transfer by currents in the water, and *C* represents heat that is felt in the air surrounding the pot.



Which table correctly identifies the types of heat transfer at *A*, *B*, and *C*?

Letter	Type of Heat Transfer
A	conduction
B	radiation
C	convection

(1)

Letter	Type of Heat Transfer
A	radiation
B	conduction
C	convection

(3)

Letter	Type of Heat Transfer
A	conduction
B	convection
C	radiation

(2)

Letter	Type of Heat Transfer
A	radiation
B	convection
C	conduction

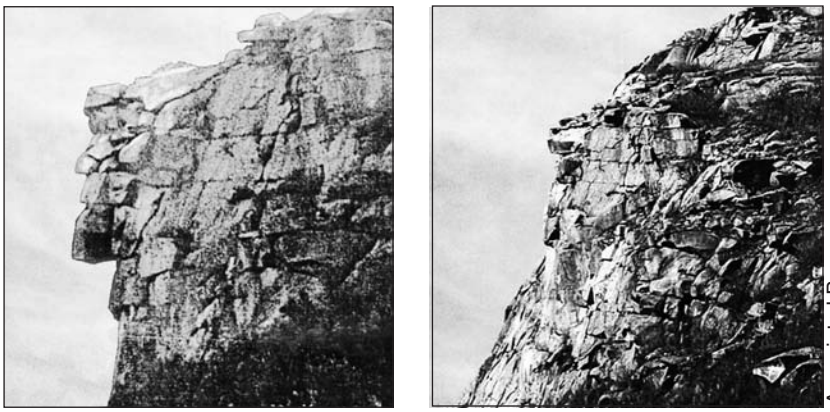
(4)

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 39 on the photographs and news article below.



Associated Press

Granite profile of the Old Man of the Mountain is shown before the collapse, and after

Old Man's Loss Felt in New Hampshire

FRANCONIA, N.H. — Crowds of visitors were drawn to Franconia Notch on Sunday to mourn the loss of New Hampshire's well-known symbol — the Old Man of the Mountain granite profile.

The 700-ton natural formation was just a pile of rocks after breaking loose from its 1,200-foot-high mountainside perch. It was unclear when the outcropping fell because clouds had obscured the area Thursday and Friday; a state park trail crew discovered the collapse Saturday morning.

The famous mountain's history dates millions of years. Over time, nature carved out a 40-foot-tall profile resembling an old man's face, and it eventually became New Hampshire's most recognizable symbol.

The Buffalo News, May 5, 2003

36 Which agent of erosion is most likely responsible for the collapse of the granite profile?

(1) running water
(2) glacial ice
(3) wave action
(4) mass movement

37 The granite bedrock formed when

(1) sediments were buried
(2) a volcano erupted
(3) magma cooled underground
(4) limestone recrystallized

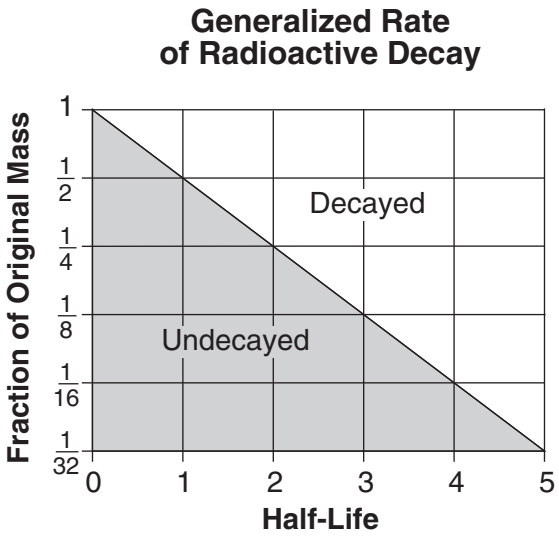
38 The rock of the Old Man of the Mountain most likely includes a mineral with a composition of

(1) NaCl
(2) SiO_2
(3) FeS_2
(4) PbS

39 What does granite bedrock found high on a mountaintop indicate?

(1) The crust has been sinking.
(2) Global temperatures have cooled.
(3) A large amount of erosion has occurred.
(4) Sea level has risen.

Base your answers to questions 40 and 41 on the graph below, which shows the generalized rate of decay of radioactive isotopes over 5 half-lives.



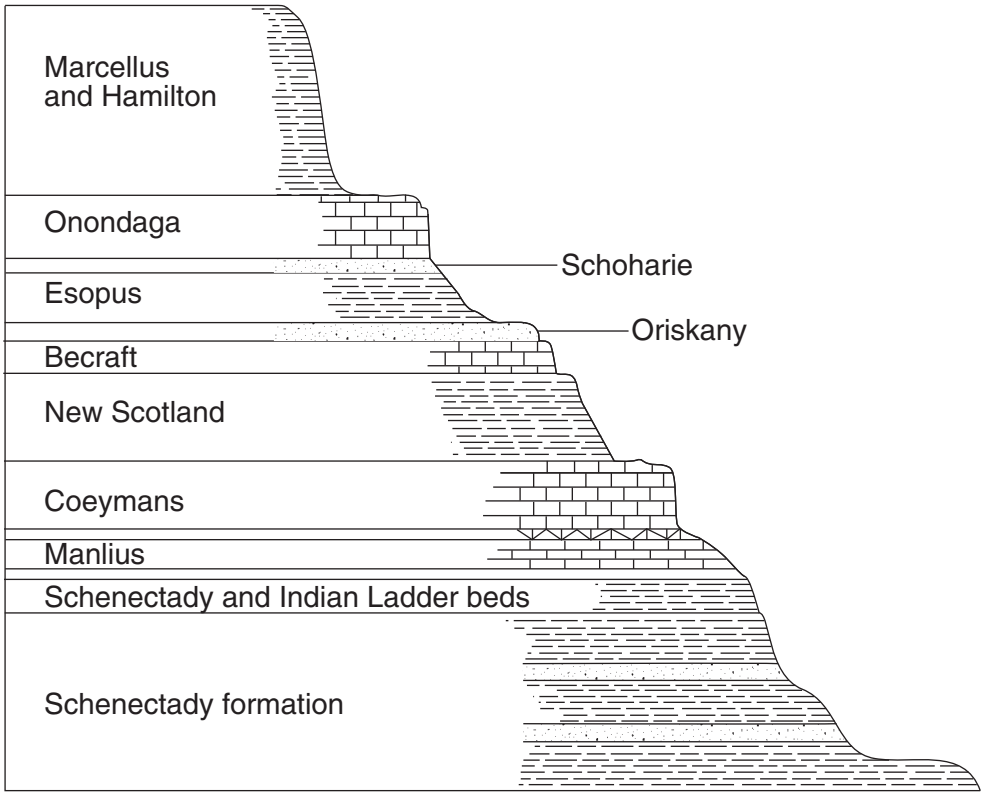
40 If the original mass of a radioactive isotope was 24 grams, how many grams would remain after 3 half-lives?

(1) 12
(2) 24
(3) 3
(4) 6

41 Which radioactive isotope takes the greatest amount of time to undergo the change shown on the graph?

(1) carbon-14
(2) potassium-40
(3) uranium-238
(4) rubidium-87

Base your answers to questions 42 through 44 on the cross section below, which shows the bedrock of a portion of the Helderberg Escarpment, located in Thacher State Park near Albany, New York. The rock formations are identified by name.



42 Which formations appear to be the most resistant to weathering?

(1) Esopus and Oriskany
(2) Onondaga and Coeymans
(3) Schoharie, and Marcellus and Hamilton
(4) New Scotland, and Schenectady and Indian Ladder beds

43 What is the main factor that causes the bedrock to weather at different rates?

(1) elevation above sea level
(2) mineral composition
(3) age of rock layers
(4) environment of formation

44 The Manlius layer formed during the early Devonian Period. What type of fossils could possibly be found in the Manlius layer?

(1) earliest birds
(2) earliest reptiles
(3) *Tetragraptus*
(4) *Ctenocrinus*

Base your answers to questions 45 through 47 on the data table below, which shows information about the four largest asteroids found in our solar system.

Data Table

Name	**Average Diameter** (kilometers)	**Period of Revolution** (years)
Ceres	848.4	4.60
Pallas	498.1	4.61
Juno	247.0	4.36
Vesta	468.3	3.63

45 The asteroids shown in the data table are located between the orbits of

(1) Venus and Earth
(2) Earth and Mars
(3) Mars and Jupiter
(4) Jupiter and Saturn

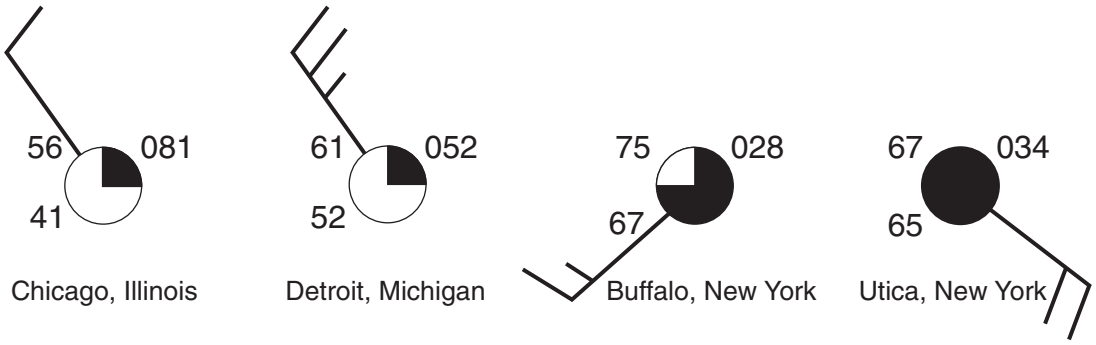
46 Compared to the diameter of Earth's Moon, the diameter of Ceres is about

(1) one-fourth of the Moon's diameter
(2) one-half of the Moon's diameter
(3) twice the diameter of the Moon
(4) four times the diameter of the Moon

47 The surface rocks of Vesta contain significant amounts of the mineral pyroxene. If rocks on Vesta are similar to rocks on Earth, which two igneous rocks would most likely be found on the surface of Vesta?

(1) basalt and scoria
(2) dunite and granite
(3) peridotite and pumice
(4) rhyolite and pegmatite

Base your answers to questions 48 through 50 on the station models below, which show various weather conditions recorded at the same time on the same day at four different cities.



48 Which wind speed was recorded at Detroit?

(1) 15 knots
(2) 25 knots
(3) 35 knots
(4) 45 knots

49 Which city had the lowest relative humidity?

(1) Chicago
(2) Detroit
(3) Buffalo
(4) Utica

50 Which weather symbol best represents the type of precipitation that was most likely occurring in Utica?

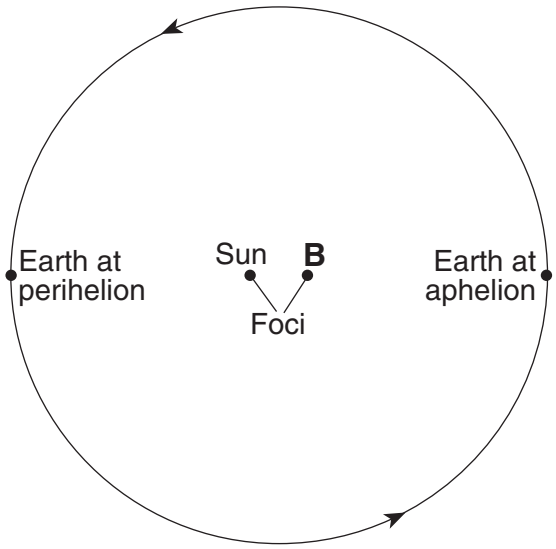
(1) (2) (3) (4)

Part B–2

Answer all questions in this part.

Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 51 through 53 on the diagram below, which represents a model of Earth's orbit. Earth is closest to the Sun at one point in its orbit (perihelion) and farthest from the Sun at another point in its orbit (aphelion). The Sun and point *B* represent the foci of this orbit.



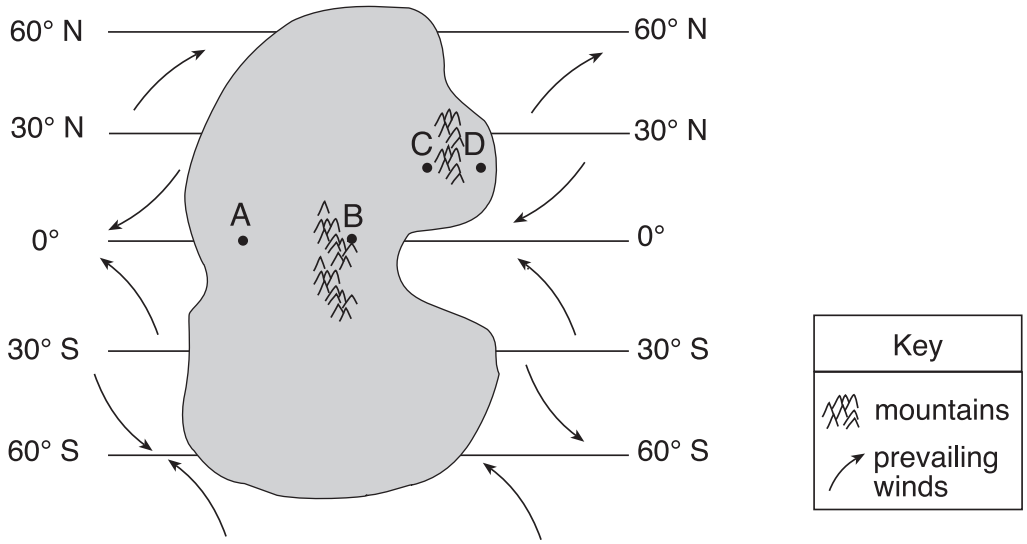
(Not drawn to scale)

51 Explain why Earth's orbit is considered to be elliptical. [1]

52 Describe the change that takes place in the gravitational attraction between Earth and the Sun as Earth moves from perihelion to aphelion and back to perihelion during one year. [1]

53 Describe how the shape of Earth's orbit would differ if the Sun and focus *B* were farther apart. [1]

Base your answers to questions 54 through 56 on the map below, which shows an imaginary continent on a planet that has climate conditions similar to Earth. The continent is surrounded by oceans. Two mountain ranges are shown. Points *A* through *D* represent locations on the continent.



54 Identify *one* labeled latitude on this continent where a high-pressure zone exists and dry air is sinking to the surface. Include *both* the unit and compass direction in your answer. [1]

55 Identify *one* factor that causes a colder climate at location *B* than at location *A*. [1]

56 Explain why location *C* has a warmer and drier climate than location *D*. [1]

Base your answers to questions 57 through 59 on the passage below and on your knowledge of stars and galaxies.

Stars

Stars can be classified according to their properties, such as diameter, mass, luminosity, and temperature. Some stars are so large that the orbits of the planets in our solar system would easily fit inside them.

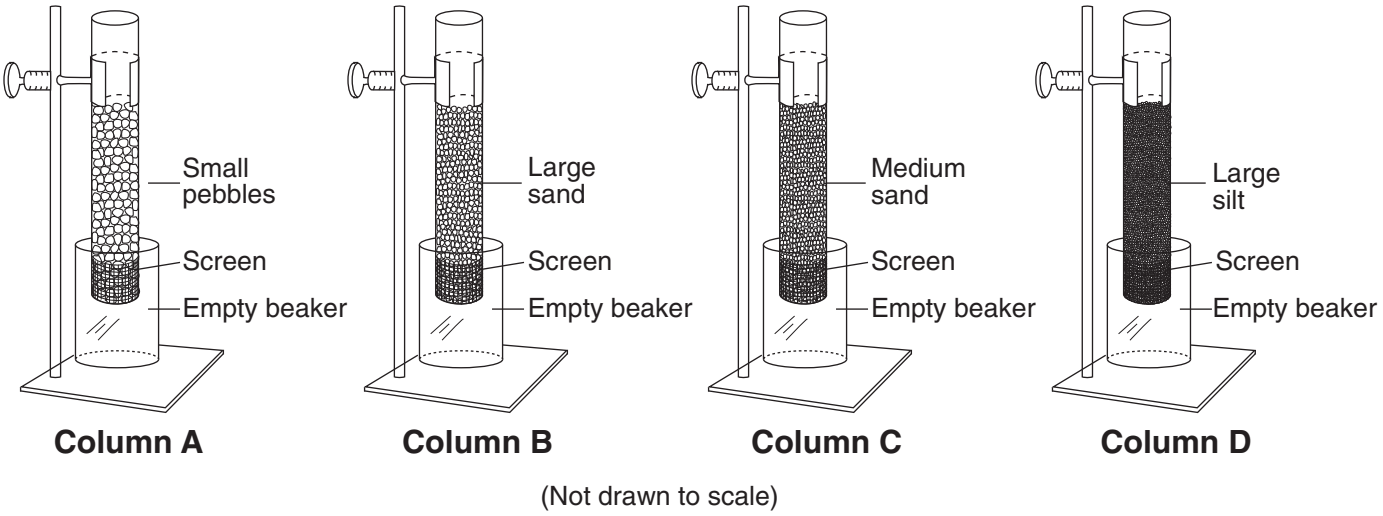
Stars are grouped together in galaxies covering vast distances. Galaxies contain from 100 billion to over 300 billion stars. Astronomers have discovered billions of galaxies in the universe.

57 Arrange the terms *galaxy*, *star*, and *universe* in order from largest to smallest. [1]

58 Complete the table *in your answer booklet* by placing an **X** in the boxes that indicate the temperature and luminosity of each star compared to our Sun. [1]

59 The star *Betelgeuse* is farther from Earth than the star *Aldebaran*. Explain why *Betelgeuse* appears brighter or more luminous than *Aldebaran*. [1]

Base your answers to questions 60 through 62 on the diagram below, which shows laboratory materials used for an investigation of the effects of sediment size on permeability, porosity, and water retention. Four separate columns, labeled *A* through *D*, were filled to the same level with different sediments. The sediments within each column are of uniform size.

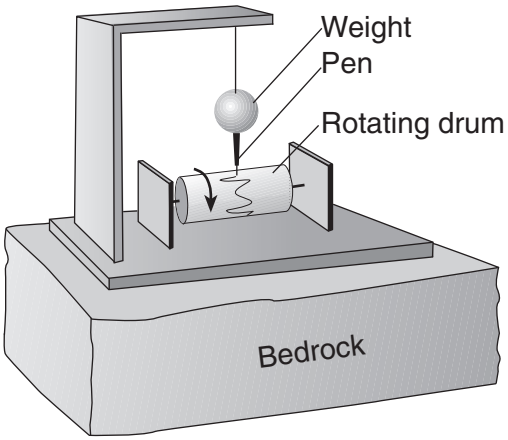


60 Which column contains particles with a diameter of 0.4 cm? [1]

61 Describe the relationship between the sediment size and the permeability that will be observed when water is poured through these sediments. [1]

62 An equal amount of water is poured through each column. On the grid *in your answer booklet*, draw a line to show the relative amount of water retained in the sediment after the water flows through each column. [1]

Base your answers to questions 63 through 65 on the diagram below, which shows a seismograph that recorded seismic waves from an earthquake located 4000 kilometers from this seismic station.



63 State *one* possible cause of the earthquake that resulted in the movement of the bedrock detected by this seismograph. [1]

64 Which type of seismic wave was recorded first on the rotating drum? [1]

65 How long does the first *S*-wave take to travel from the earthquake epicenter to this seismograph? [1]

_____

Part C

Answer all questions in this part.

Directions (66–85): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *Earth Science Reference Tables*.

Base your answers to questions 66 through 68 on the information below about a solar eclipse that will occur on August 21, 2017. The latitude and longitude coordinates for the movement of the center of the Moon's shadow across Earth's surface are given in the table.

Data Table

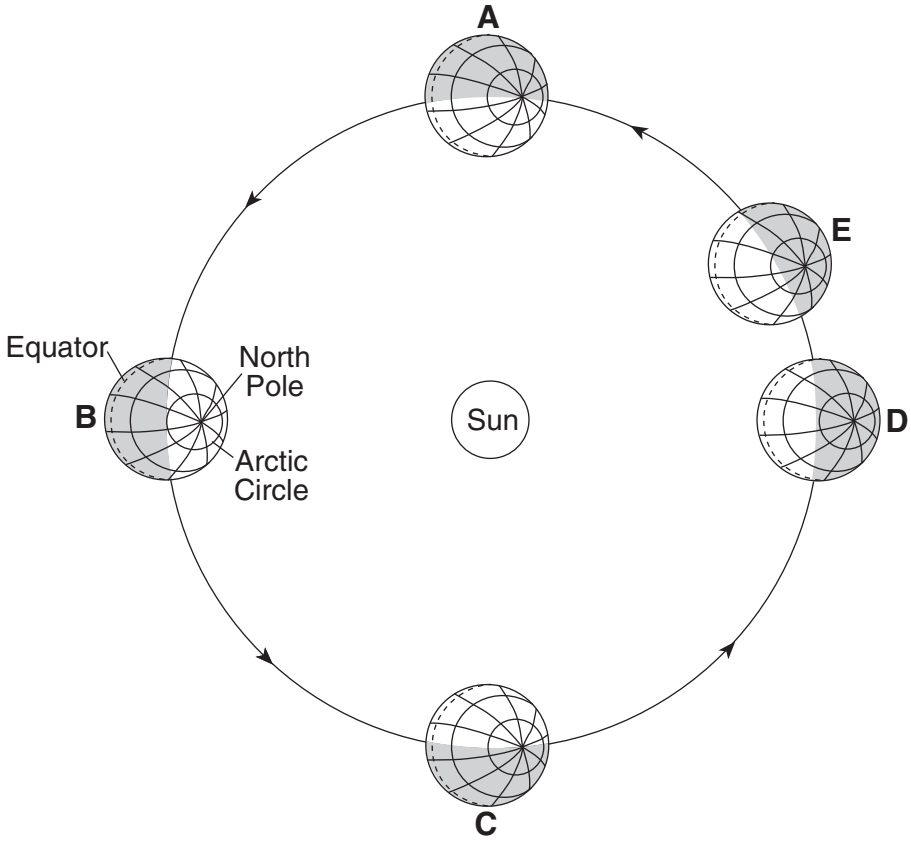
Shadow Position Number	Latitude (° N)	Longitude (° W)
1	45.0	130.0
2	44.0	114.5
3	42.0	103.0
4	39.5	94.0
5	36.0	86.0
6	32.5	78.5
7	28.5	71.0

66 On the graph *in your answer booklet*, plot with an **X** the path of the center of the Moon's shadow for each position given in the data table. Connect the **X**s with a smooth, curved line. Shadow position number 1 has been plotted on the graph. [1]

67 The path of the Moon's shadow will be approximately 100 kilometers wide. On the graph *in your answer booklet*, shade the area between positions 1 and 2 to show the width of the Moon's shadow on Earth. [1]

68 On the diagram *in your answer booklet*, place an **X** on the Moon's orbit to show the Moon's position during a solar eclipse. [1]

Base your answers to questions 69 through 71 on the diagram below, which shows the parts of Earth experiencing daylight and darkness as Earth orbits the Sun. Letters *A*, *B*, *C*, *D*, and *E* are positions in Earth's orbit as viewed from above the Northern Hemisphere.



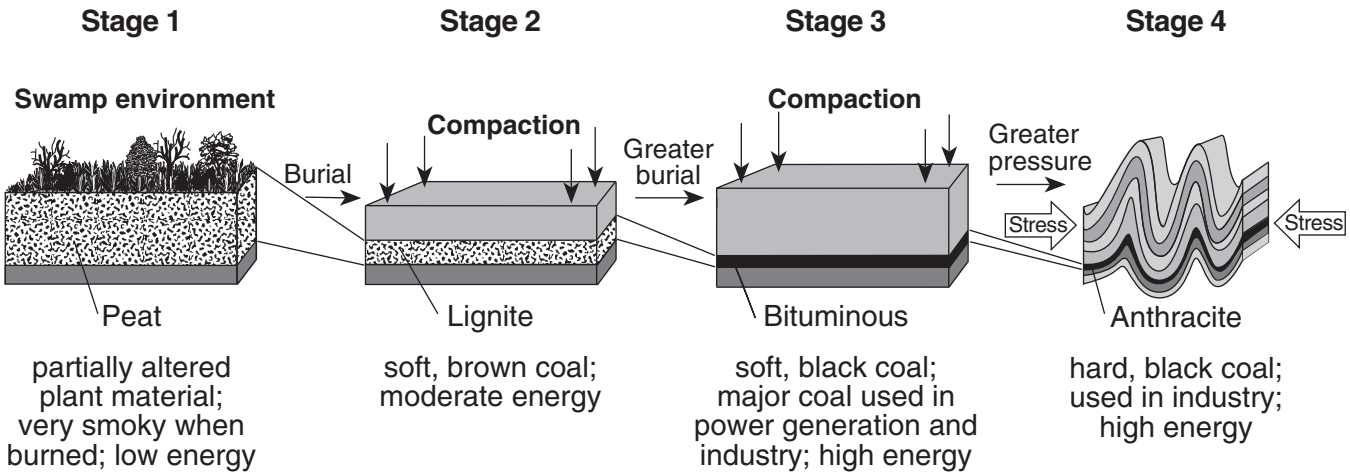
(Not drawn to scale)

69 Approximately how many days does it take Earth to move from position *A* to position *C* in its orbit? [1]

70 Which season is the Northern Hemisphere experiencing when Earth is at position *E*? [1]

71 On the grid *in your answer booklet*, place **X**s to show the duration of insolation at the Arctic Circle (66.5° N) as Earth orbits the Sun at positions *A*, *B*, *C*, and *D*. Connect the **X**s with a line. [1]

Base your answers to questions 72 through 74 on the sequence of diagrams below, which shows four stages in coal formation.



72 Which type of rock is forming above the coal material during stages 2 and 3? [1]

73 State the form of coal which normally has the highest density and explain why. [1]

74 Explain why coal deposits are *not* found in bedrock older than Silurian-age bedrock. [1]

Base your answers to questions 75 through 78 on the weather map in your answer booklet, which shows a low-pressure system located over central United States. Points *A*, *B*, and *C* represent locations on Earth's surface. The isobars on the map show air pressures in millibars.

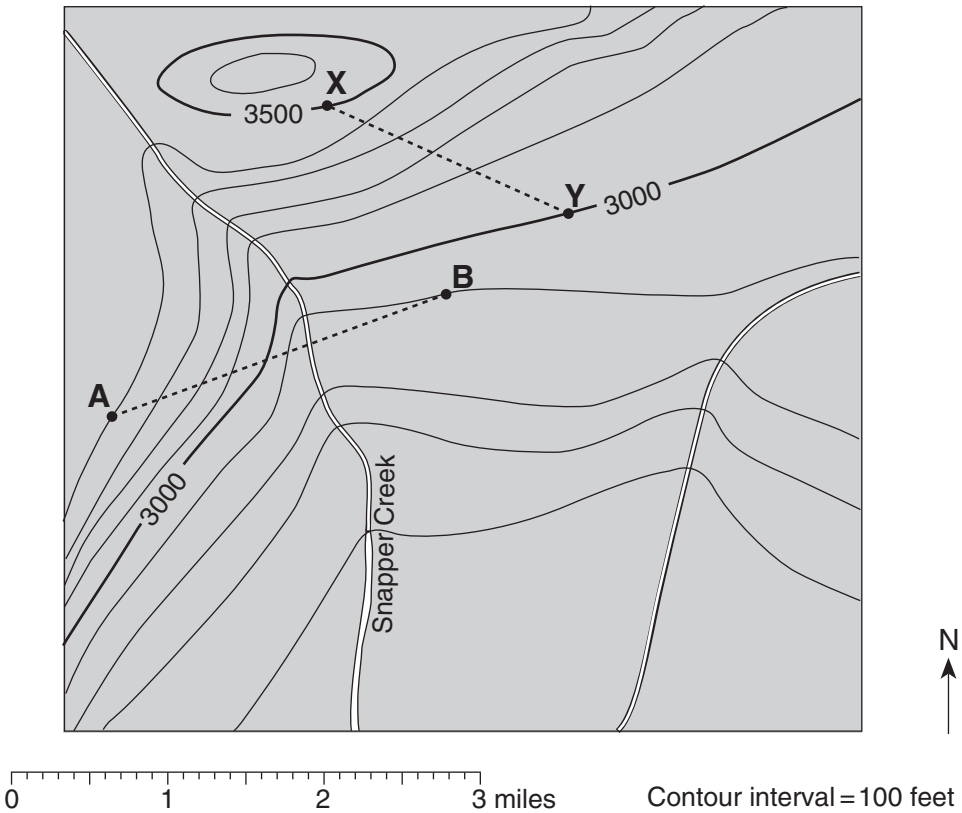
75 On the map *in your answer booklet*, draw an arrow, beginning at the **L**, to show the direction the low-pressure center will most likely move in the next two days. [1]

76 What evidence shown on the map indicates that point *B* is most likely experiencing precipitation? [1]

77 What is the two-letter symbol used on a weather map to indicate the warm, moist air mass that is over point *C*? [1]

78 What evidence shown on the weather map indicates that point *C* is experiencing greater wind speeds than point *A*? [1]

Base your answers to questions 79 through 81 on the topographic map below. Points *A*, *B*, *X*, and *Y* are locations on Earth's surface.



79 On the grid *in your answer booklet*, construct a topographic profile of the land surface along line *AB* by plotting an **X** for the elevation of each contour line that crosses line *AB*. Connect the **X**s with a smooth, curved line to complete the profile. [1]

80 Toward which compass direction is Snapper Creek flowing? [1]

81 Calculate the gradient between points *X* and *Y*. Units must be included in your answer. [1]

_____

Base your answers to questions 82 through 85 on the passage below and on the diagram in your answer booklet.

Siccar Point

The diagram shows a unique rock formation exposed at Siccar Point, on the east coast of Scotland. The bedrock at Siccar Point shows an unconformity, which is a surface where two separate sets of rock layers that formed at different times come into contact.

The bottom rock layers are graywacke, which is a form of sandstone, formed approximately 425 million years ago when tectonic plates collided. This plate movement caused the layers of graywacke to tilt into their present vertical orientation and eventually uplifted them above sea level to form mountains.

By about 345 million years ago, these mountains had been eroded to form a plain that submerged beneath the sea. More sediment was deposited on top of the vertical graywacke layers, eventually forming the nearly horizontal layers called the Old Red Sandstone.

82 On the diagram *in your answer booklet*, draw a dark, heavy line tracing the unconformity separating the graywacke from the Old Red Sandstone. [1]

83 During which geologic time period did the graywacke bedrock form? [1]

84 Describe the structural evidence shown by the bedrock at Siccar Point that led geologists to conclude that the graywacke was moved by converging tectonic plates. [1]

85 Identify *two* of the processes that produced the unconformity at Siccar Point. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Thursday, August 13, 2009 — 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 must 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

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Thursday, August 13, 2009 — 12:30 to 3:30 p.m., only

ANSWER BOOKLET

Student ..... Sex: ☐ Male ☐ 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: 16)

Part	Maximum Score	Student's Score
A	35	
B–1	15	
B–2	15	
C	20	

Total Written Test Score (Maximum Raw Score: 85)

Final Score (from conversion chart)

Raters' Initials:

Rater 1 ..... **Rater 2** .....

Part B–2

51 _____

_____

52 _____

_____

53 _____

_____

For Raters Only

51

52

53

For Raters Only

54 _____ 54 ☐

55 _____ 55 ☐

56 _____ 56 ☐

_____

57 _____ _____ _____ 57 ☐

Largest ⟶ Smallest

58

	Temperature		Luminosity	
Stars	Hotter	Cooler	Brighter	Dimmer
Procyon B				
Barnard's Star				
Rigel				

58 ☐

59 _____ 59 ☐

_____

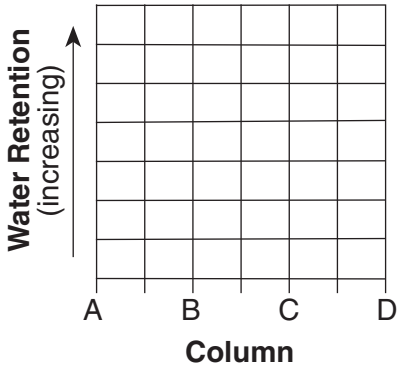
For Raters Only

60 Column: _____ **60**

61 _____ **61**

_____

62



62

63 _____ **63**

64 _____ **64**

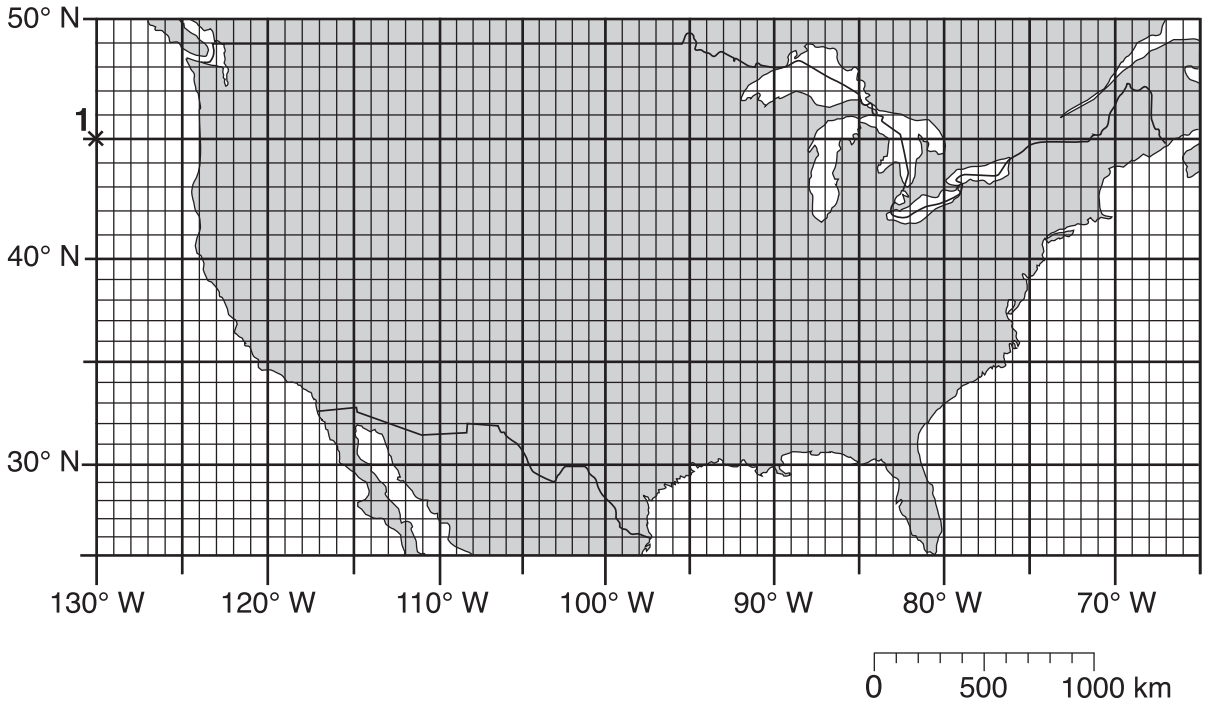
65 _____ **min** _____ **sec** **65**

Total Score for Part B–2

For Raters Only

Part C

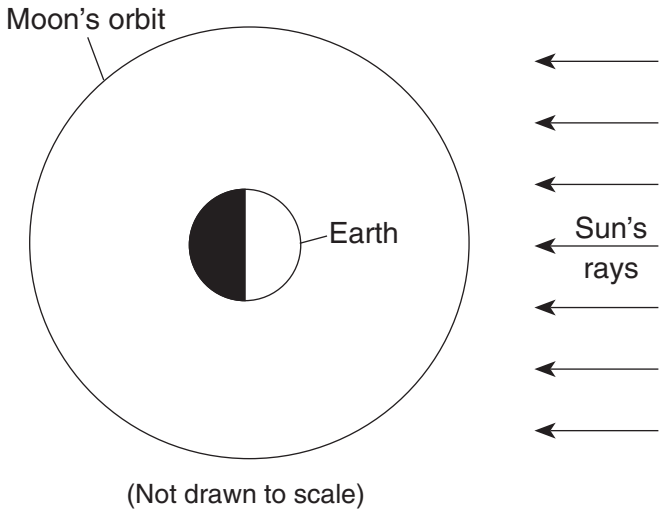
66–67



66 ☐

67 ☐

68



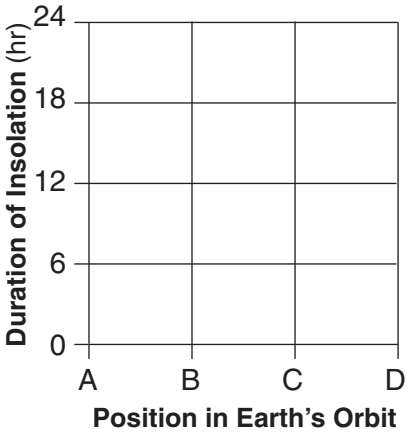
68 ☐

For Raters Only

69 _____ **days** 69

70 _____ 70

71



71

72 _____ 72

73 Form of coal: _____

Explanation: _____ 73

_____

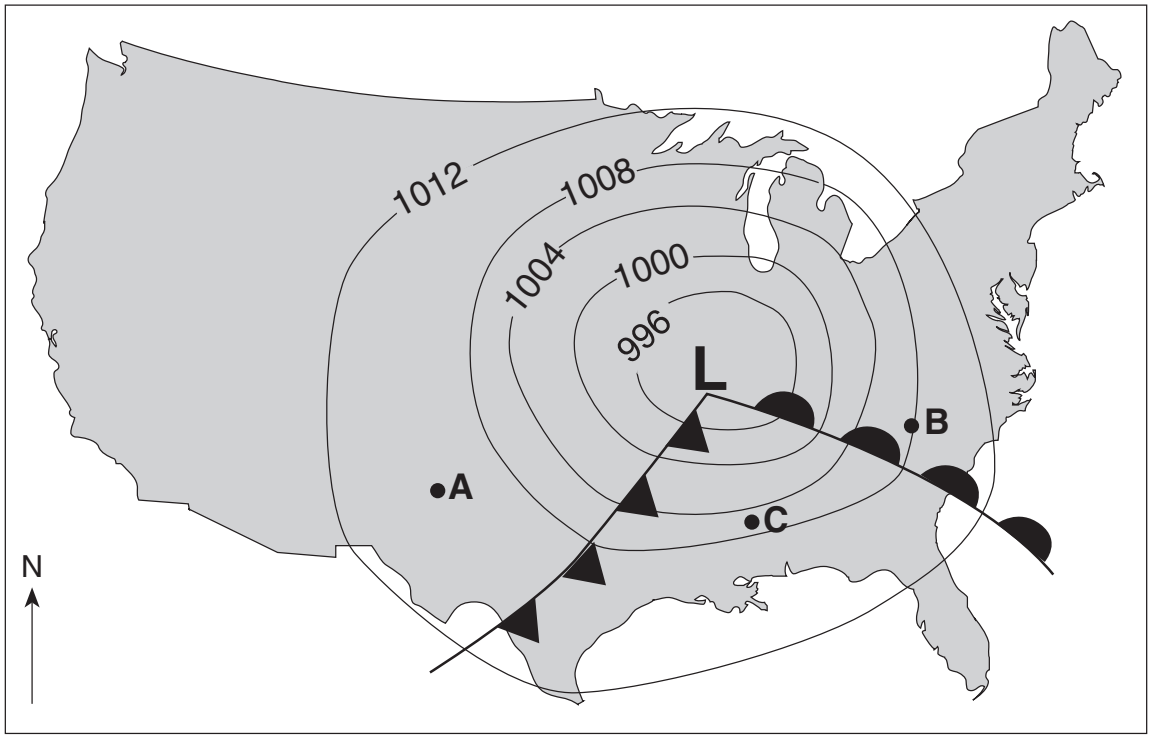
74 _____ 74

_____

[OVER]

For Raters Only

75



76 _____

_____

77 _____

78 _____

_____

75 ☐

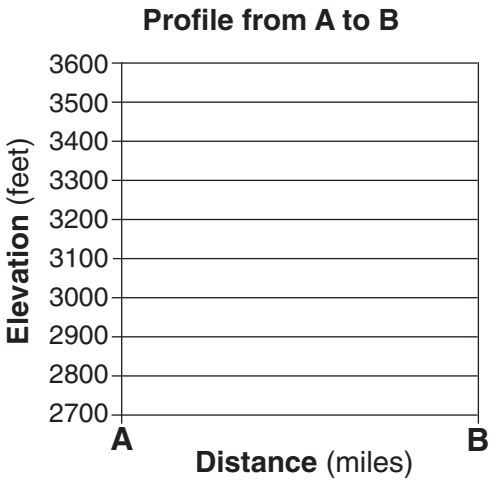
76 ☐

77 ☐

78 ☐

For Raters Only

79



79

80 _____

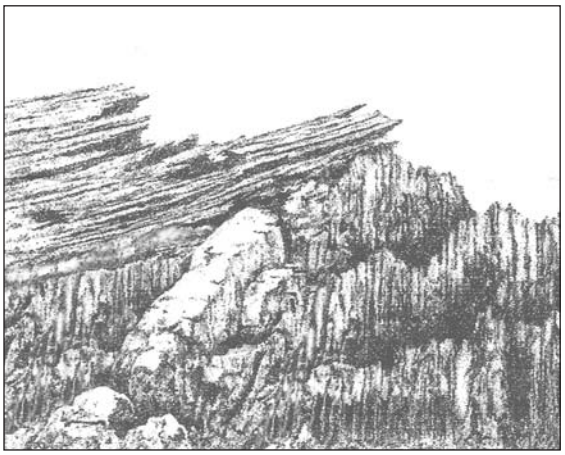
80

81 _____

81

For Raters Only

82



82

83 _____ **Period**

83

84 _____

_____

84

85 Process 1: _____

Process 2: _____

85

Total Score for Part C

PS/EARTH SCIENCE

FOR TEACHERS ONLY

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

PS–ES PHYSICAL SETTING/EARTH SCIENCE

Thursday, August 13, 2009 — 12:30 to 3:30 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 3 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site http://www.emsc.nysed.gov/osa/ and select the link "Examination Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents examination period.

Part A and Part B–1
Allow 1 credit for each correct response.

Part A

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

Part B–1

36	4	44	4
37	3	45	3
38	2	46	1
39	3	47	1
40	3	48	2
41	4	49	1
42	2	50	4
43	2		

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Physical Setting/Earth Science examination. Additional information about scoring is provided in the publication *Information Booklet for Scoring Regents Examinations in the Sciences*.

Use only *red* ink or *red* pencil in rating Regents papers. Do *not* correct the student's work by making insertions or changes of any kind.

On the detachable answer sheet for Part A and Part B–1, indicate by means of a check mark each incorrect or omitted answer. In the box provided at the end of each part, record the number of questions the student answered correctly for that part.

At least two science teachers must participate in the scoring of each student's responses to the Part B–2 and Part C open-ended questions. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score all the open-ended questions on a student's answer paper.

Students' responses must be scored strictly according to the Scoring Key and Rating Guide. For open-ended questions, credit may be allowed for responses other than those given in the rating guide if the response is a scientifically accurate answer to the question and demonstrates adequate knowledge as indicated by the examples in the rating guide. In the student's answer booklet, record the number of credits earned for each answer in the box printed to the right of the answer lines or spaces for that question.

Fractional credit is *not* allowed. Only whole-number credit may be given to a response. Units need not be given when the wording of the questions allows such omissions.

Raters should enter the scores earned for Part A, Part B–1, Part B–2, and Part C on the appropriate lines in the box printed on the answer booklet and then should add these four scores and enter the total in the box labeled "Total Written Test Score." The student's score for the Earth Science Performance Test should be entered in the space provided. Then, the student's raw scores on the performance test and written test should be converted to a scaled score by using the conversion chart that will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, August 13, 2009. The student's scaled score should be entered in the labeled box on the student's answer booklet. The scaled score is the student's final examination score.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate, and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided for that administration be used to determine the student's final score.

Part B–2

Allow a total of 15 credits for this part. The student must answer all questions in this part.

51 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The distance from the Sun varies.

— There are two foci instead of one center.

— The orbit is an oval shape.

— Earth's eccentricity of orbit is 0.017.

52 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The force of gravity decreases, then increases.

— Gravity becomes less, then becomes greater.

53 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The orbit would become more eccentric.

— The eccentricity would increase.

— The eccentricity value would be closer to 1.0.

— The path would be more elliptical.

54 [1] Allow 1 credit for either 30° N *or* 30° S.

55 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Location *B* is located high in the mountains.

— Location *A* is located at a lower elevation.

56 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Location *C* is located in air that is sinking, compressing, and warming.

— Location *C* is on the leeward side of a mountain.

— Location *D* is near a large body of water.

— Air traveling over the mountains loses its moisture at *D*.

57 [1] Allow 1 credit for:

universe — galaxy — star

Largest → Smallest

58 [1] Allow 1 credit if all *six* boxes are correctly marked as shown.

	Temperature		**Luminosity**	
Stars	Hotter	Cooler	Brighter	Dimmer
Procyon B	X			X
Barnard's Star		X		X
Rigel	X		X	

59 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— *Betelgeuse* is larger.

— *Betelgeuse* is more massive than *Aldebaran*.

— *Aldebaran* has less volume.

60 [1] Allow 1 credit for *A*.

61 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

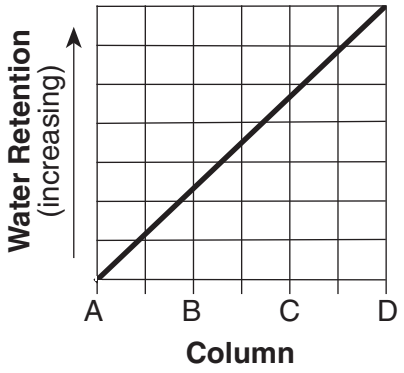
— the larger the sediment size, the greater the permeability

— the smaller the particles, the slower the water flows through

— There is a direct relationship.

62 [1] Allow 1 credit for a line that shows water retention increasing from column *A* to column *D*.

Example of a 1-credit response:



63 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— tectonic plate movement

— movement along a fault

— volcanic eruption

64 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— *P*-wave

— primary wave

— compressional wave

65 [1] Allow 1 credit for any response from 12 min 30 sec to 12 min 50 sec.

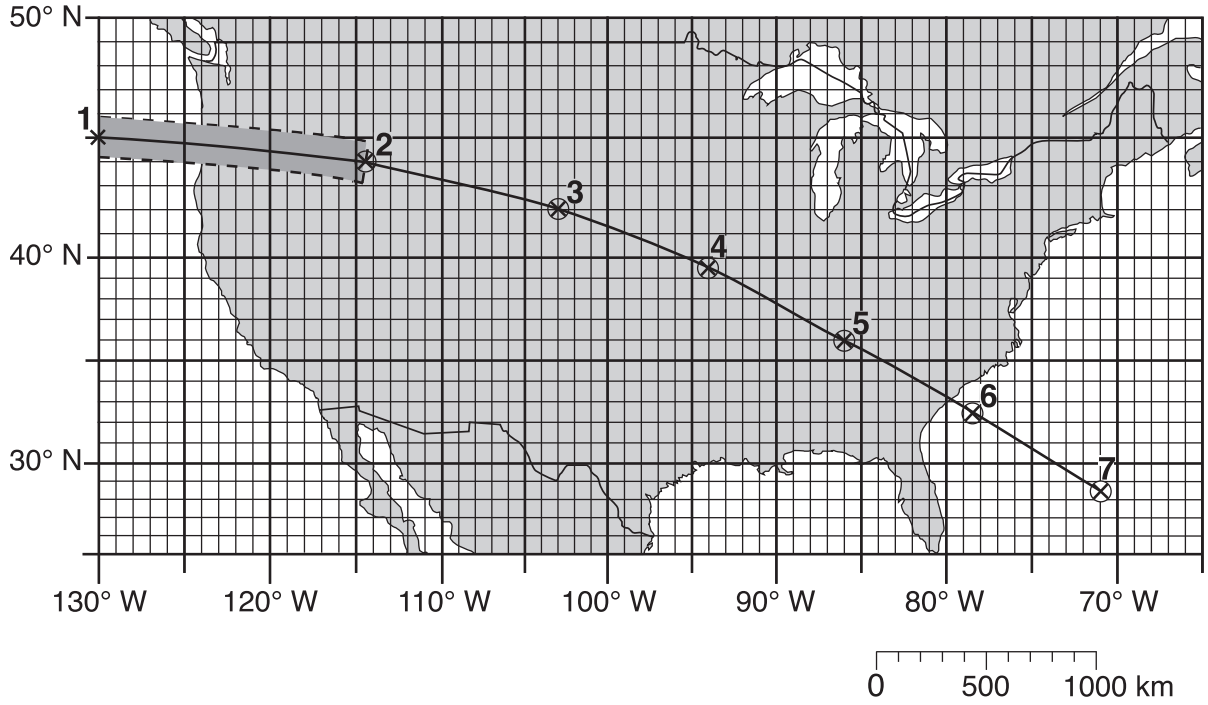
Part C

Allow a total of 20 credits for this part. The student must answer all questions in this part.

66 [1] Allow 1 credit if the centers of five or six student-plotted **X**s are correctly plotted within the circles shown and connected with a line that passes through the circles.

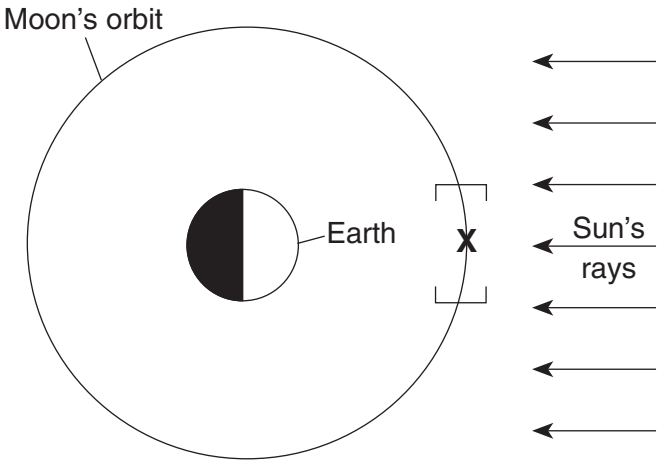
67 [1] Allow 1 credit for a shadow band between position 1 and the student-located position 2 that falls within the designated shaded width shown below.

Example of a 2-credit response for questions 66 and 67:



68 [1] Allow 1 credit if the center of the student's **X** is within the bracketed area shown on the Moon's orbit.

Example of a 1-credit response:



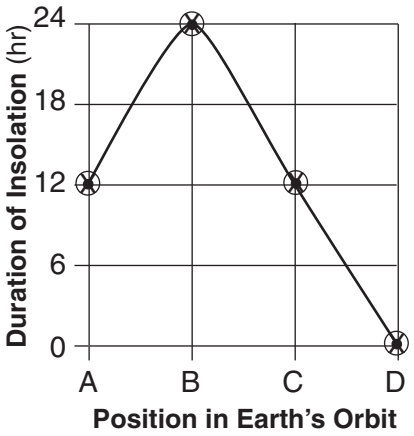
(Not drawn to scale)

69 [1] Allow 1 credit for any value from 182 to 187 days.

70 [1] Allow 1 credit for winter.

71 [1] Allow 1 credit if all four **X**s are plotted within the circles shown and are connected with a line that passes through the circles.

Example of a 1-credit response:



72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— sedimentary

— any clastic sedimentary rock *or* specific clastic sedimentary rock name

73 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Form of coal:

— anthracite

— hard coal

— metamorphic coal

Explanation:

— It forms under greater pressures, which increases density.

— Anthracite is the metamorphic form of coal.

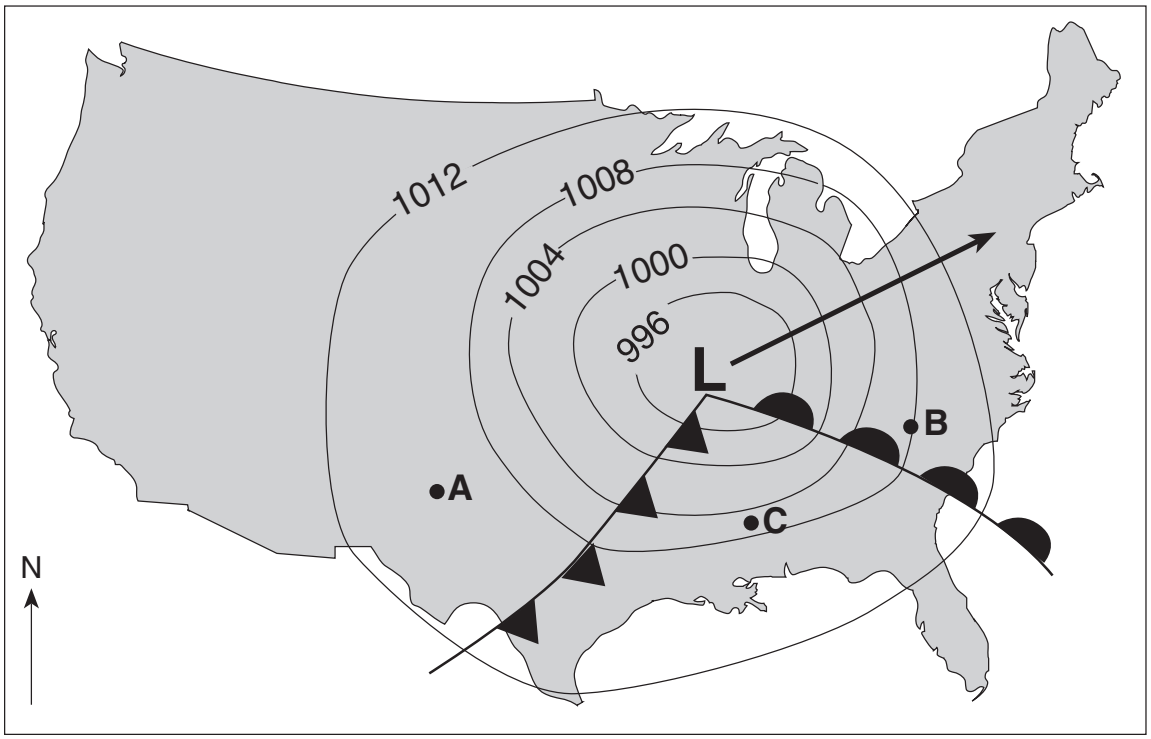
74 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Earliest land plants did not occur until the Silurian.

— Extensive coal-forming forests didn't exist until the Carboniferous Period.

75 [1] Allow 1 credit for an arrow beginning at the **L** and pointing in any direction from due east to north northeast.

Example of a 1-credit response:



76 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— *B* is being affected by a warm front.

— Precipitation often occurs ahead of a warm front.

— *B* is located close to a frontal boundary.

77 [1] Allow 1 credit for mT. Allow credit for either uppercase or lowercase letters. Do *not* allow credit if the letters are reversed, such as Tm.

78 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

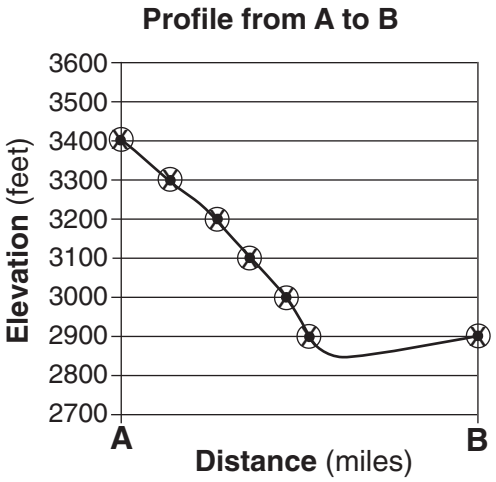
— *C* is between isobars that are closely spaced.

— *A* is located in an area with a small pressure gradient.

— The isobars are closer together at *C*.

79 [1] Allow 1 credit if the centers of all seven **X**s are plotted within the circles shown below and are connected with a line that passes through the circles. The line must extend below the 2900-foot line, and above the 2800-foot line.

Example of a 1-credit response:



80 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— SE

— south southeast

— south

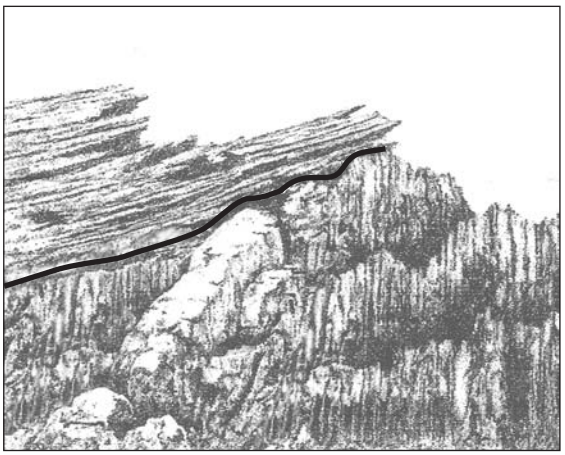
81 [1] Allow 1 credit for any value from 277 to 313 with correct units. Acceptable units include, but are not limited to:

— ft/mi

— feet per mile

82 [1] Allow 1 credit for correctly drawing the line of unconformity as shown below.

Example of a 1-credit response:



83 [1] Allow 1 credit for Silurian Period.

84 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The graywacke layers are tilted.

— The layers are now vertical.

— The unconformity indicates that the graywacke layers were uplifted and eroded.

85 [1] Allow 1 credit for *two* acceptable responses. Acceptable responses include, but are not limited to:

— uplift

— weathering

— erosion

— tilting

— submergence

— burial

— deposition

Regents Examination in Physical Setting/Earth Science

August 2009

Chart for Converting Total Test Raw Scores to Final Examination Scores (Scaled Scores)

The *Chart for Determining the Final Examination Score for the August 2009 Regents Examination in Physical Setting/Earth Science* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, August 13, 2009. Conversion charts provided for previous administrations of the Regents Examination in Physical Setting/Earth Science must NOT be used to determine students' final scores for this administration.

Submitting Online Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to www.emsc.nysed.gov/osa/exameval.
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the SUBMIT button at the bottom of the page to submit the completed form.

Map to Core Curriculum

August 2009 Physical Setting/Earth Science			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		42, 43, 46, 51, 62	66, 71, 81
Math Key Idea 2	25	51, 52, 53, 58, 65	
Math Key Idea 3	2	40, 45	
Science Inquiry Key Idea 1		39, 55, 56	74
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3	3, 11, 12, 27	37, 38, 41, 44, 46, 47, 59	83
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			75
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1		47	85
Key Idea 2	2, 6, 20, 21, 22, 24, 26, 29, 30, 31, 32, 33, 34, 35	36, 42, 45, 48, 49, 50, 51, 52, 53, 54, 55, 56, 60, 61, 63, 64	68, 69, 70, 71, 72, 73, 75, 76, 77, 78, 79, 80, 81, 82, 84
Key Idea 3	25	57	67, 79
Key Idea 4			
Key Idea 5	1, 5, 14, 33	40, 52, 53	66, 72
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4			
Key Idea 1	1, 2, 3, 4, 5, 6, 7, 8, 9, 21, 23, 25, 29, 33, 34	40, 41, 44, 45, 46, 51, 52, 53, 57, 58, 59, 61, 62	66, 67, 68, 69, 70, 74, 82, 83, 84, 85
Key Idea 2	10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 24, 26, 28, 30, 31, 32, 35	36, 39, 42, 43, 48, 49, 50, 54, 55, 56, 60, 63, 64, 65	71, 75, 76, 77, 78, 79, 80, 81, 84
Key Idea 3	18, 27	37, 38, 47	72, 73
Reference Tables			
ESRT 2001 Edition (Revised)	3, 11, 12, 13, 18, 19, 25, 27, 30, 31	37, 38, 41, 44, 45, 46, 47, 48, 49, 50, 51, 54, 58, 59, 60, 65	72, 74, 76, 77, 78, 81, 83

University of the State of New York
State Education Department

Regents Examination in Physical Setting/Earth Science – August 2009

Chart for Converting Total Test Raw Scores to Final Examination Scores (Scale Scores)

(Not to be used for the Braille Edition)

To determine the student's final score, locate the student's Total Performance Test Score across the top of the chart and the Total Written Test Score down the side of the chart. The point where the two scores intersect is the student's final examination score. For example, a student receiving a Total Performance Test Score of 10 and Total Written Test Score of 71 would receive a final examination score of 90.

Total Performance Test Score

Total Written Test Score	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
85	100	99	99	99	99	98	97	97	96	95	94	93	92	90	89	87	85
84	99	99	98	98	98	97	96	96	95	94	93	92	91	89	88	86	84
83	99	99	98	98	97	97	96	96	95	94	93	92	91	89	88	86	84
82	99	98	98	98	97	96	96	95	94	93	92	91	90	89	87	86	84
81	98	98	98	97	97	96	95	95	94	93	92	91	90	88	87	85	83
80	98	98	97	97	96	96	95	94	93	93	92	90	89	88	86	85	83
79	97	97	97	96	96	95	95	94	93	92	91	90	89	87	86	84	82
78	97	97	96	96	95	95	94	93	93	92	91	90	88	87	85	84	82
77	96	96	96	95	95	94	94	93	92	91	90	89	88	86	85	83	81
76	96	96	95	95	94	94	93	92	92	91	90	89	87	86	84	83	81
75	95	95	95	94	94	93	92	92	91	90	89	88	87	85	84	82	80
74	95	94	94	94	93	93	92	91	90	90	88	87	86	85	83	82	80
73	94	94	93	93	93	92	91	91	90	89	88	87	86	84	83	81	79
72	94	93	93	92	92	91	91	90	89	88	87	86	85	84	82	80	79
71	93	93	92	92	91	91	90	89	89	88	87	86	84	83	81	80	78
70	92	92	92	91	91	90	90	89	88	87	86	85	84	83	81	79	77
69	92	92	91	91	90	90	89	88	87	87	86	84	83	82	80	79	77
68	91	91	90	90	90	89	88	88	87	86	85	84	83	81	80	78	76
67	90	90	90	89	89	88	88	87	86	85	84	83	82	81	79	77	75
66	90	90	89	89	88	88	87	86	85	85	84	82	81	80	78	77	75
65	89	89	88	88	88	87	86	86	85	84	83	82	81	79	78	76	74
64	89	88	88	87	87	86	86	85	84	83	82	81	80	79	77	75	74
63	88	88	87	87	86	86	85	84	83	83	82	80	79	78	76	75	73
62	87	87	86	86	85	85	84	83	83	82	81	80	79	77	76	74	72
61	86	86	86	85	85	84	84	83	82	81	80	79	78	76	75	73	71
60	86	85	85	84	84	83	83	82	81	80	79	78	77	76	74	72	71
59	85	85	84	84	83	83	82	81	81	80	79	78	76	75	73	72	70
58	84	84	83	83	82	82	81	81	80	79	78	77	76	74	73	71	69
57	83	83	83	82	82	81	80	80	79	78	77	76	75	73	72	70	68
56	83	82	82	81	81	80	80	79	78	77	76	75	74	73	71	69	68
55	82	81	81	81	80	79	79	78	77	76	75	74	73	72	70	69	67
54	81	81	80	80	79	79	78	77	77	76	75	74	72	71	69	68	66
53	80	80	79	79	78	78	77	77	76	75	74	73	72	70	69	67	65
52	79	79	79	78	78	77	76	76	75	74	73	72	71	69	68	66	64
51	78	78	78	77	77	76	76	75	74	73	72	71	70	69	67	65	63
50	78	77	77	76	76	75	75	74	73	72	71	70	69	68	66	64	63
49	77	76	76	76	75	74	74	73	72	71	70	69	68	67	65	64	62
48	76	75	75	75	74	74	73	72	71	71	69	68	67	66	64	63	61
47	75	75	74	74	73	73	72	71	71	70	69	68	66	65	63	62	60
46	74	74	73	73	72	72	71	70	70	69	68	67	65	64	62	61	59
45	73	73	72	72	71	71	70	69	69	68	67	66	65	63	62	60	58
44	72	72	71	71	70	70	69	69	68	67	66	65	64	62	61	59	57

Final Examination Scores
August 2009 Examination in Physical Setting/Earth Science – continued

Total Performance Test Score

Total Written Test Score	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
43	71	71	70	70	69	69	68	67	67	66	65	64	63	61	60	58	56
42	70	70	69	69	68	68	67	67	66	65	64	63	62	60	59	57	55
41	69	69	68	68	67	67	66	66	65	64	63	62	61	59	58	56	54
40	68	68	67	67	66	66	65	65	64	63	62	61	60	58	57	55	53
39	67	67	66	66	65	65	64	64	63	62	61	60	59	57	56	54	52
38	66	66	65	65	64	64	63	62	62	61	60	59	58	56	55	53	51
37	65	65	64	64	63	63	62	61	61	60	59	58	56	55	53	52	50
36	64	64	63	63	62	62	61	60	60	59	58	57	55	54	52	51	49
35	63	63	62	62	61	61	60	59	59	58	57	56	54	53	51	50	48
34	62	61	61	61	60	60	59	58	57	57	55	54	53	52	50	49	47
33	61	60	60	59	59	58	58	57	56	55	54	53	52	51	49	47	46
32	60	59	59	58	58	57	57	56	55	54	53	52	51	50	48	46	45
31	58	58	58	57	57	56	55	55	54	53	52	51	50	48	47	45	43
30	57	57	56	56	56	55	54	54	53	52	51	50	49	47	46	44	42
29	56	56	55	55	54	54	53	52	52	51	50	49	47	46	44	43	41
28	55	55	54	54	53	53	52	51	50	50	49	47	46	45	43	42	40
27	54	53	53	52	52	51	51	50	49	48	47	46	45	44	42	40	39
26	52	52	52	51	51	50	50	49	48	47	46	45	44	42	41	39	37
25	51	51	50	50	49	49	48	48	47	46	45	44	43	41	40	38	36
24	50	50	49	49	48	48	47	46	46	45	44	43	41	40	38	37	35
23	49	48	48	47	47	46	46	45	44	43	42	41	40	39	37	35	34
22	47	47	47	46	46	45	44	44	43	42	41	40	39	37	36	34	32
21	46	46	45	45	44	44	43	42	42	41	40	39	37	36	34	33	31
20	45	44	44	43	43	42	42	41	40	39	38	37	36	35	33	31	30
19	43	43	42	42	42	41	40	40	39	38	37	36	35	33	32	30	28
18	42	42	41	41	40	40	39	38	38	37	36	35	33	32	30	29	27
17	41	40	40	39	39	38	38	37	36	35	34	33	32	31	29	27	26
16	39	39	38	38	37	37	36	36	35	34	33	32	31	29	28	26	24
15	38	37	37	36	36	35	35	34	33	32	31	30	29	28	26	24	23
14	36	36	35	35	35	34	33	33	32	31	30	29	28	26	25	23	21
13	35	34	34	34	33	33	32	31	30	30	28	27	26	25	23	22	20
12	33	33	33	32	32	31	31	30	29	28	27	26	25	23	22	20	18
11	32	32	31	31	30	30	29	28	28	27	26	25	23	22	20	19	17
10	30	30	30	29	29	28	28	27	26	25	24	23	22	21	19	17	15
9	29	29	28	28	27	27	26	25	25	24	23	22	20	19	17	16	14
8	27	27	27	26	26	25	25	24	23	22	21	20	19	18	16	14	12
7	26	26	25	25	24	24	23	22	22	21	20	19	17	16	14	13	11
6	24	24	24	23	23	22	22	21	20	19	18	17	16	14	13	11	9
5	23	23	22	22	21	21	20	19	18	18	17	15	14	13	11	10	8
4	21	21	21	20	20	19	18	18	17	16	15	14	13	11	10	8	6
3	20	19	19	19	18	17	17	16	15	14	13	12	11	10	8	7	5
2	18	18	17	17	17	16	15	15	14	13	12	11	10	8	7	5	3
1	17	16	16	15	15	14	14	13	12	11	10	9	8	7	5	3	2
0	15	15	14	14	13	13	12	11	11	10	9	8	6	5	3	2	0