

PHYSICAL SETTING EARTH SCIENCE

Thursday, August 17, 2017 — 8:30 to 11:30 a.m., only

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

Use your knowledge of Earth science to answer all questions in this examination. Before you begin this examination, you must be provided with the *2011 Edition Reference Tables for Physical Setting/Earth Science*. You will need these reference tables to answer some of the questions.

You are to answer all questions in all parts of this examination. You may use scrap paper to work out the answers to the questions, but be sure to record your answers on your answer sheet and in your answer booklet. A separate answer sheet for Part A and Part B–1 has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet. Record your answers to the Part A and Part B–1 multiple-choice questions on this separate answer sheet. Record your answers for the questions in Part B–2 and Part C in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

All answers in your answer booklet should be written in pen, except for graphs and drawings, which should be done in pencil.

When you have completed the examination, you must sign the declaration printed on 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 *2011 Edition Reference Tables for Physical Setting/Earth Science* must be available for you to use while taking this examination.

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, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Earth Science*. Record your answers on your separate answer sheet.

1 In which sequence are the celestial objects correctly listed in order from the smallest mass to the largest mass?

- (1) Saturn, solar system, Milky Way, universe
- (2) Saturn, universe, Milky Way, solar system
- (3) Milky Way, Saturn, solar system, universe
- (4) Milky Way, universe, solar system, Saturn

2 The red shift of light from distant galaxies provides evidence that these galaxies are

- (1) decreasing in size
- (2) increasing in size
- (3) decreasing in distance from Earth
- (4) increasing in distance from Earth

3 The best evidence of Earth's rotation is provided by the

- (1) Foucault pendulum and global warming
- (2) Foucault pendulum and Coriolis effect
- (3) Moon phases and global warming
- (4) Moon phases and Coriolis effect

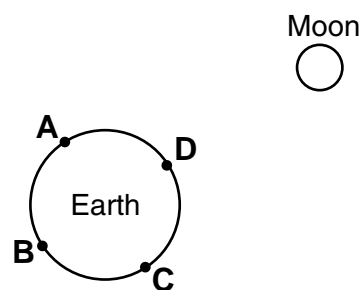
4 Which sphere of Earth covers approximately 70% of Earth's surface?

- (1) atmosphere
- (2) lithosphere
- (3) hydrosphere
- (4) asthenosphere

5 Some of the constellations that are visible to New York State observers at midnight in December are different from the constellations that are visible at midnight in June because

- (1) constellations rotate on an axis
- (2) constellations revolve around Earth
- (3) Earth rotates on its axis
- (4) Earth revolves around the Sun

6 The diagram below represents Earth and the Moon as viewed from above the North Pole. Points A, B, C, and D are locations on Earth's surface.



(Not drawn to scale)

According to the diagram, where will high ocean tides and low ocean tides most likely be located?

- (1) high tides at A and B; low tides at C and D
- (2) high tides at B and D; low tides at A and C
- (3) high tides at A and C; low tides at B and D
- (4) high tides at C and D; low tides at A and B

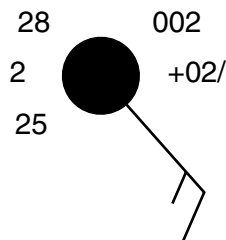
7 Urbanization affects the amount of vegetation and runoff in an area by

- (1) decreasing vegetation and decreasing runoff
- (2) decreasing vegetation and increasing runoff
- (3) increasing vegetation and decreasing runoff
- (4) increasing vegetation and increasing runoff

8 A severe thunderstorm warning was issued on a warm summer afternoon. Which present weather symbol represents the dangerous solid form of precipitation that is commonly associated with some of these severe thunderstorms?

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

9 The station model below represents the weather conditions for a location in New York State.



The barometric trend for the past three hours at this location indicates a steady increase of

- (1) 0.2 mb
- (2) 2.0 mb
- (3) 0.002 mb
- (4) 0.02 mb

10 Which New York State location is most often affected by lake-effect snow storms caused by winds blowing over Lake Ontario?

- (1) Jamestown
- (2) Plattsburgh
- (3) Oswego
- (4) Riverhead

11 Which type of air mass would most likely form over the Pacific Ocean north of the Aleutian Trench?

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

12 Mount Kilimanjaro is located in eastern Africa at 3° S. Which climate factor best explains the presence of permanent snow on its peak?

- (1) latitude
- (2) elevation
- (3) prevailing winds
- (4) ocean currents

13 In which portion of the electromagnetic spectrum is the maximum intensity of Earth's outgoing radiation?

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

14 A solar water heater contains fluid-filled tubing that absorbs sunlight energy on its outside surface. Which tubing exterior will best absorb insolation?

- (1) dark-colored and rough
- (2) dark-colored and smooth
- (3) light-colored and rough
- (4) light-colored and smooth

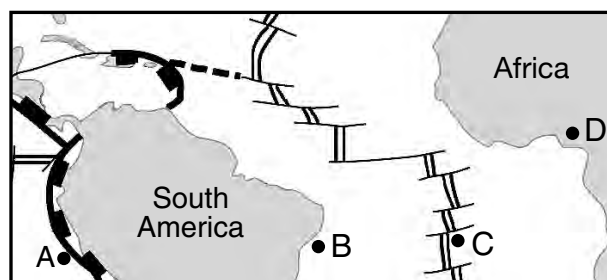
15 Equal masses of granite, iron, copper, and lead are placed in sunlight. Based on specific heat, which material will warm up the fastest?

- (1) granite
- (2) iron
- (3) copper
- (4) lead

16 During explosive volcanic eruptions, large amounts of ash entering Earth's atmosphere often rise to an altitude of 20 kilometers. What is the most likely effect of this ash cloud?

- (1) a decrease in the insolation reaching Earth's surface
- (2) a decrease in the thickness of Earth's stratosphere layer
- (3) an increase in the insolation reaching Earth's surface
- (4) an increase in the thickness of Earth's stratosphere layer

17 The map below shows some tectonic plate boundaries near South America and Africa. Letters A, B, C, and D represent locations on Earth's surface.

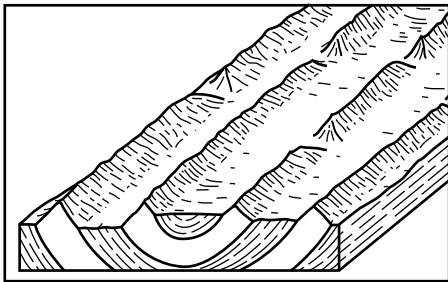


Which location most likely has the youngest bedrock?

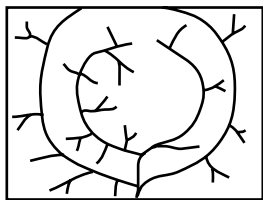
- (1) A
- (2) B
- (3) C
- (4) D

- 18 Compared to the average density and composition of oceanic crust, continental crust is
- (1) less dense and more felsic
 - (2) less dense and more mafic
 - (3) more dense and more felsic
 - (4) more dense and more mafic
- 19 The Hawaiian Islands were formed as a result of
- (1) lava flowing over Earth's surface where two tectonic plates move apart
 - (2) an oceanic plate moving over a mantle hot spot
 - (3) two oceanic plates colliding to form an island arc
 - (4) tectonic plates sliding past each other

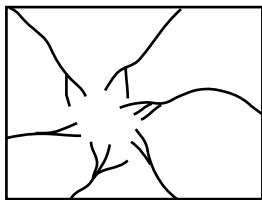
20 The block diagram below represents the underlying bedrock structure of a landscape region.



Which diagram represents the most likely stream drainage pattern on the surface of this landscape?



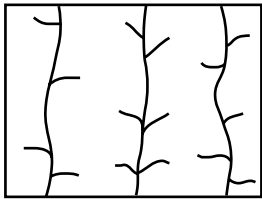
(1)



(3)



(2)



(4)

- 21 Which characteristics identify mountain landscape regions?
- (1) steep slopes with deformed bedrock
 - (2) steep slopes with horizontal bedrock
 - (3) gentle slopes with deformed bedrock
 - (4) gentle slopes with horizontal bedrock
- 22 Which agent of erosion causes the sandblasting of bedrock?
- (1) glaciers
 - (2) wind
 - (3) running water
 - (4) wave action
- 23 The photograph below shows wire netting installed over a steep rock outcrop.

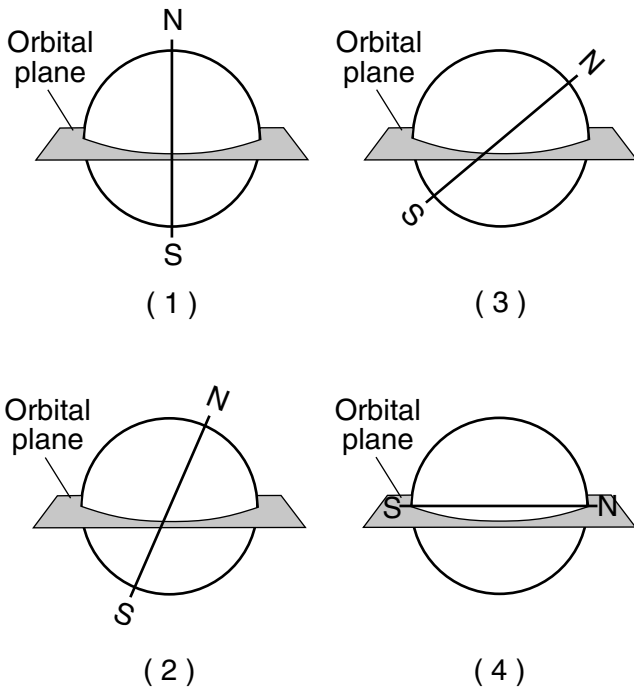


This wire netting has been installed to prevent loss of property or life resulting from

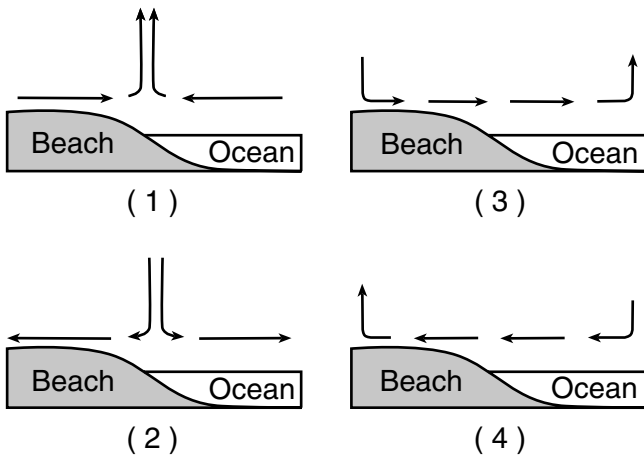
- (1) crosscutting and downwarping
 - (2) folding and faulting
 - (3) weathering and erosion
 - (4) high winds and flooding
- 24 Which two minerals are commercial sources of iron?
- (1) galena and graphite
 - (2) muscovite mica and biotite mica
 - (3) garnet and fluorite
 - (4) hematite and magnetite
- 25 Which mineral can be found in the rocks phyllite, sandstone, and granite?

- (1) quartz
- (2) pyroxene
- (3) gypsum
- (4) calcite

26 Which diagram best represents Earth's axis position relative to Earth's orbital plane?



27 In which cross section do the arrows represent the most probable direction of air movement over land and water surfaces at an ocean coast on a hot, sunny, summer afternoon?



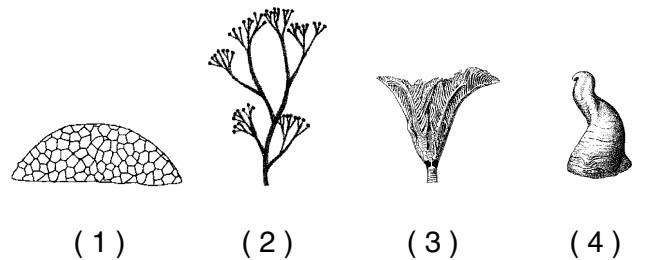
28 The table below shows the average diameter and falling velocity of five types of precipitation. The data for moderate rain have been left blank.

Type of Precipitation	Average Diameter (millimeters)	Falling Velocity (meters/second)
drizzle	0.96	4.1
light rain	1.24	4.8
moderate rain		
heavy rain	2.05	6.7
excessive rain	2.40	7.3

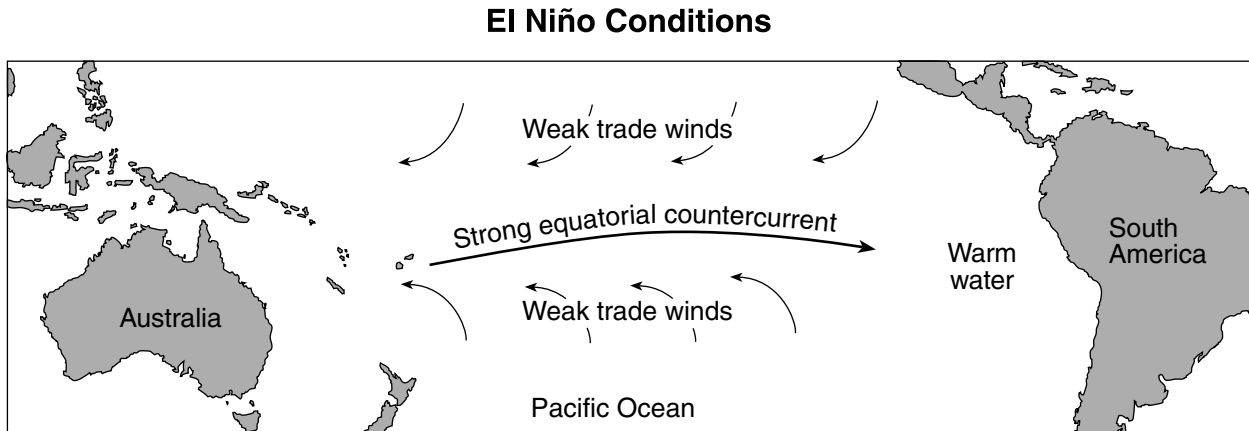
What are the probable values for the average diameter and falling velocity of the raindrops found in moderate rain?

- (1) average diameter = 1.20 mm
falling velocity = 4.6 m/sec
- (2) average diameter = 1.20 mm
falling velocity = 5.7 m/sec
- (3) average diameter = 1.60 mm
falling velocity = 4.6 m/sec
- (4) average diameter = 1.60 mm
falling velocity = 5.7 m/sec

29 Which New York State index fossil is classified as a coral?



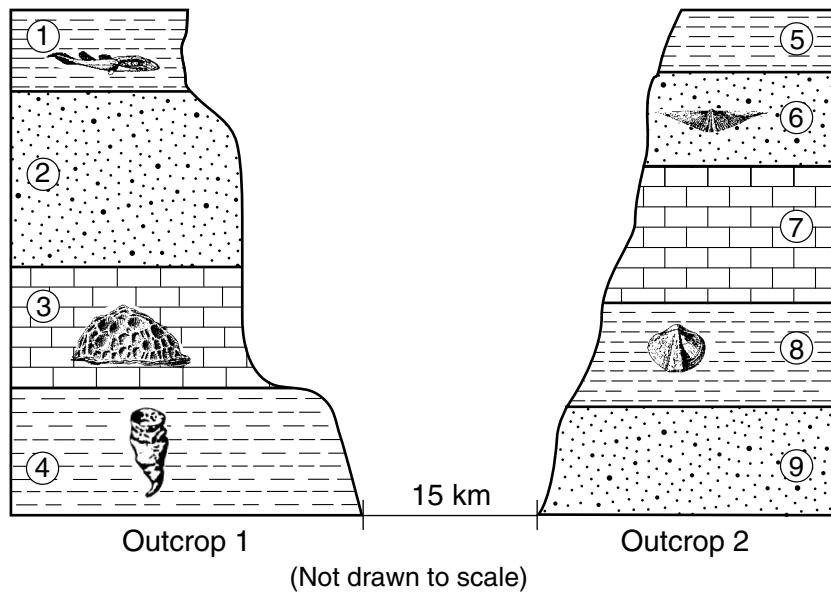
30 The map below shows the weak trade winds and strong equatorial countercurrent in the Pacific Ocean during El Niño conditions. This causes warm surface ocean water to migrate eastward, lowering the atmospheric pressure above this warm water.



What are the most likely changes to atmospheric temperature and precipitation along the west coast of South America during El Niño conditions?

- (1) lower temperatures and lower amounts of precipitation
- (2) lower temperatures and higher amounts of precipitation
- (3) higher temperatures and lower amounts of precipitation
- (4) higher temperatures and higher amounts of precipitation

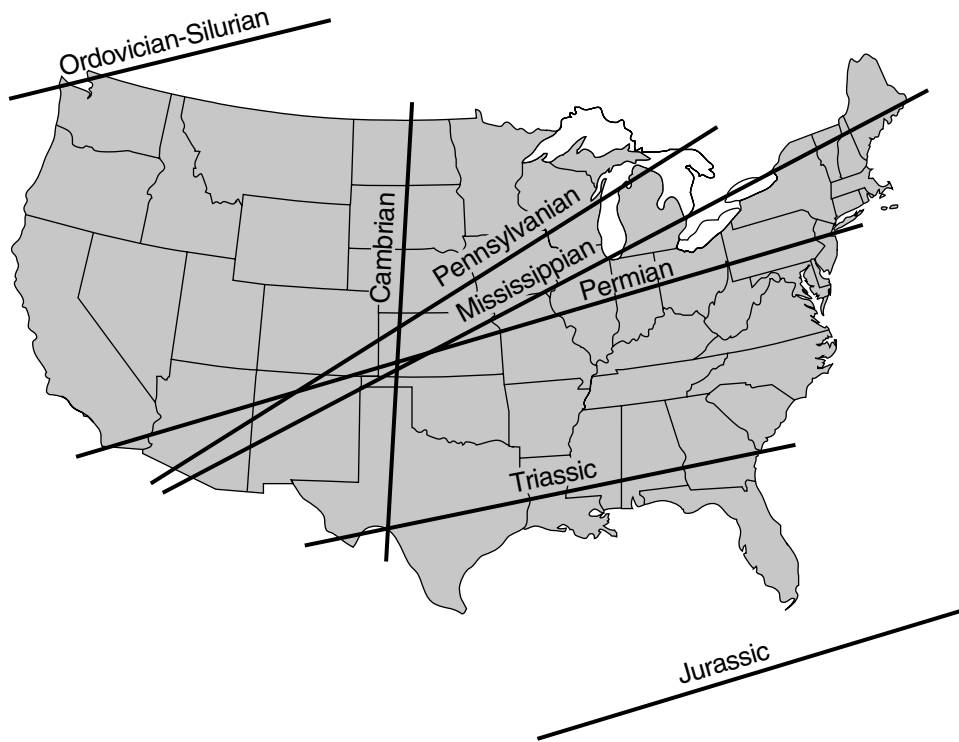
31 The cross sections below represent two bedrock outcrops 15 kilometers apart. Numbers 1 through 9 indicate rock layers. Some layers contain index fossils. No overturning of rock layers has occurred.



Which layers most likely formed during the same geologic time period?

- (1) 1 and 8
- (2) 2 and 9
- (3) 3 and 7
- (4) 4 and 5

32 Labeled lines on the map below show the inferred location of Earth's equator during the middle of several geologic periods.



Approximately how many million years ago (mya) was the region around current-day Watertown, New York, located the nearest to the equator?

- (1) 270 mya
- (2) 300 mya
- (3) 340 mya
- (4) 450 mya

33 Which table correctly matches rock textures with a sedimentary rock that exhibits each texture?

Rock Texture	Sedimentary Rock
clastic	sandstone
crystalline	breccia
bioclastic	rock gypsum

(1)

Rock Texture	Sedimentary Rock
clastic	shale
crystalline	dolostone
bioclastic	sandstone

(3)

Rock Texture	Sedimentary Rock
clastic	dolostone
crystalline	limestone
bioclastic	siltstone

(2)

Rock Texture	Sedimentary Rock
clastic	conglomerate
crystalline	rock salt
bioclastic	limestone

(4)

34 The data table below shows the dry-bulb and wet-bulb temperatures measured with a psychrometer on four different days at the same location.

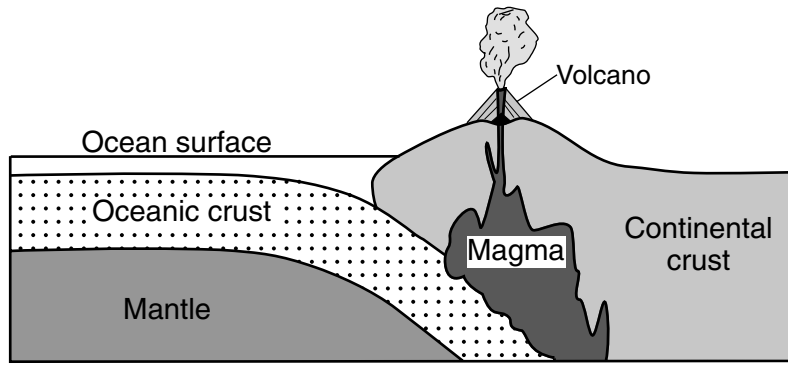
Temperatures Measured with a Psychrometer

Day	1	2	3	4
Dry-bulb temperature (°C)	0	5	10	15
Wet-bulb temperature (°C)	-5	0	5	10

According to the data shown in the table, which day had the highest relative humidity?

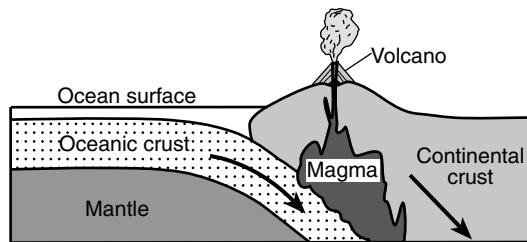
- (1) 1
- (2) 2
- (3) 3
- (4) 4

35 The cross section below represents a lithospheric plate boundary.

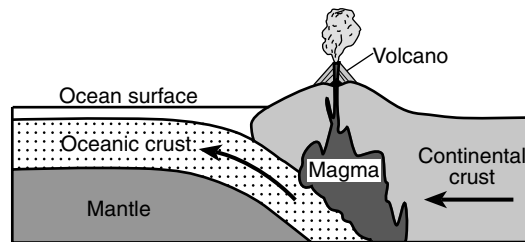


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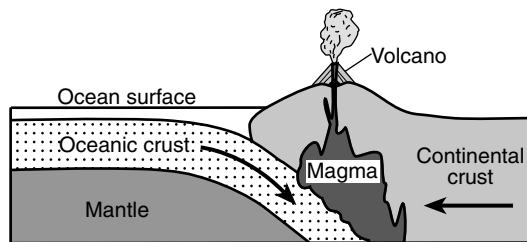
In which diagram do the arrows show the relative directions of plate movement at this type of plate boundary?



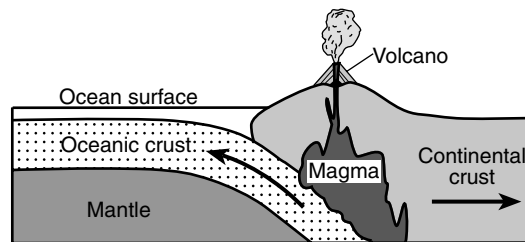
(1)



(3)



(2)



(4)

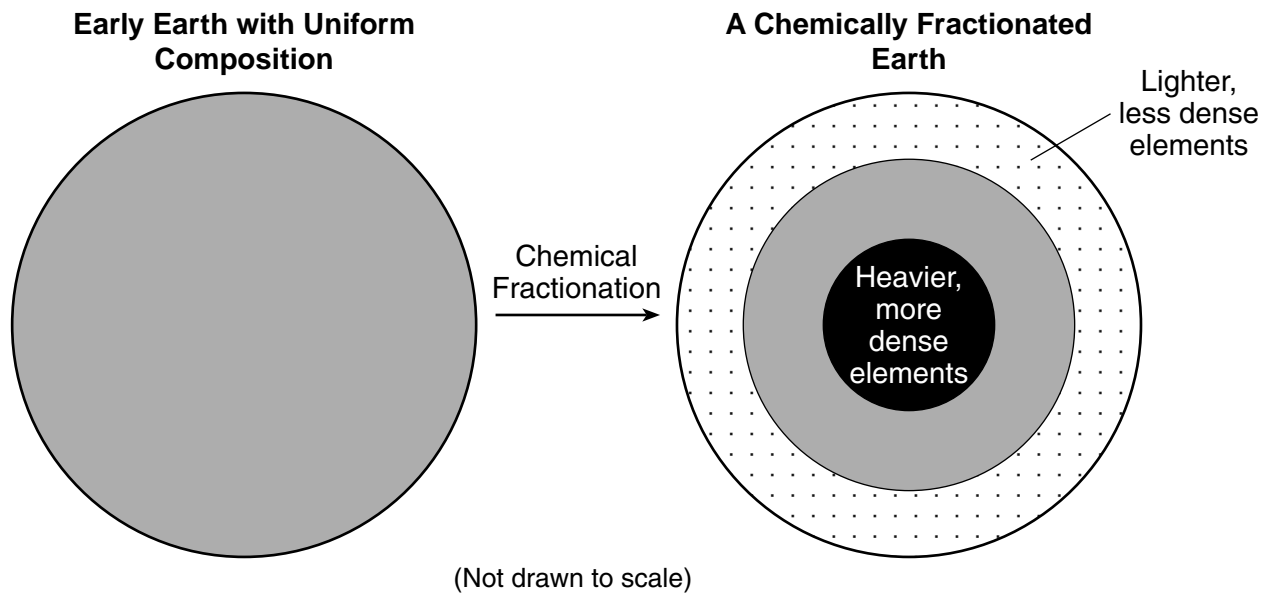
Part B-1

Answer all questions in this part.

Directions (36–50): For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the 2011 Edition Reference Tables for Physical Setting/Earth Science. Record your answers on your separate answer sheet.

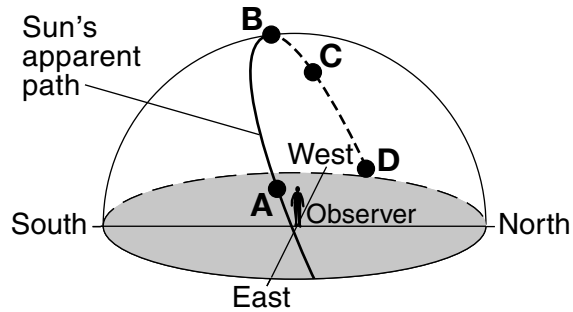
Base your answers to questions 36 through 38 on the information and diagram below and on your knowledge of Earth science. The diagram represents a simplified model of the early formation of Earth's interior.

Early in its formation, Earth was a molten mass of evenly mixed composition. During the next few million years, the heavier and more dense elements sank to the center, while lighter and less dense elements rose toward the surface. This is called chemical fractionation.



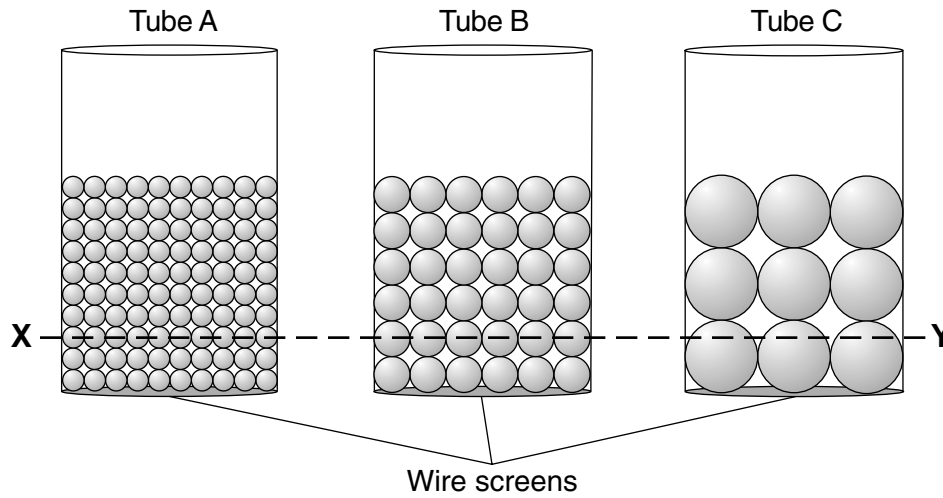
- 36 Chemical fractionation is most likely caused by
- (1) solidification
 - (2) gravity
 - (3) magnetic force
 - (4) chemical weathering
- 37 Approximately how many years ago did Earth and other planets in our solar system begin the process of chemical fractionation?
- (1) 8.2 billion years ago
 - (2) 13.8 billion years ago
 - (3) 542 million years ago
 - (4) 4600 million years ago
- 38 Which pair of elements sank to Earth's center during chemical fractionation?
- (1) aluminum and silicon
 - (2) carbon and sulfur
 - (3) iron and nickel
 - (4) oxygen and potassium

Base your answers to questions 39 through 41 on the diagram below and on your knowledge of Earth science. The diagram represents the apparent path of the Sun through the sky as viewed by an observer in the Northern Hemisphere. Points *A*, *B*, *C*, and *D* represent four positions of the Sun.

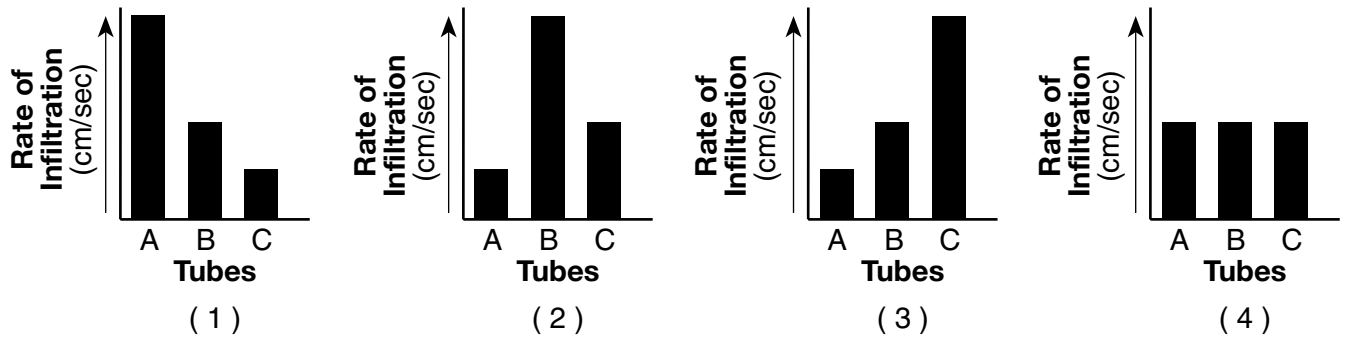


- 39 This apparent path of the Sun through the sky is caused by
- | | |
|---------------------------------------|---------------------------------------|
| (1) Earth's revolution around the Sun | (3) the Sun's revolution around Earth |
| (2) Earth's rotation on its axis | (4) the Sun's rotation on its axis |
- 40 The observer has the longest shadow when the Sun is at position
- | | |
|--------------|--------------|
| (1) <i>A</i> | (3) <i>C</i> |
| (2) <i>B</i> | (4) <i>D</i> |
- 41 What is the approximate time of day when the Sun is at position *C*?
- | | |
|------------|------------|
| (1) 6 a.m. | (3) 3 p.m. |
| (2) 9 a.m. | (4) 6 p.m. |
-

Base your answers to questions 42 and 43 on the diagram below and on your knowledge of Earth science. The diagram represents three tubes, A, B, and C, each containing an equal volume of uniform-sized spherical beads. The bottom of each tube is covered with a wire screen. XY is a reference line.



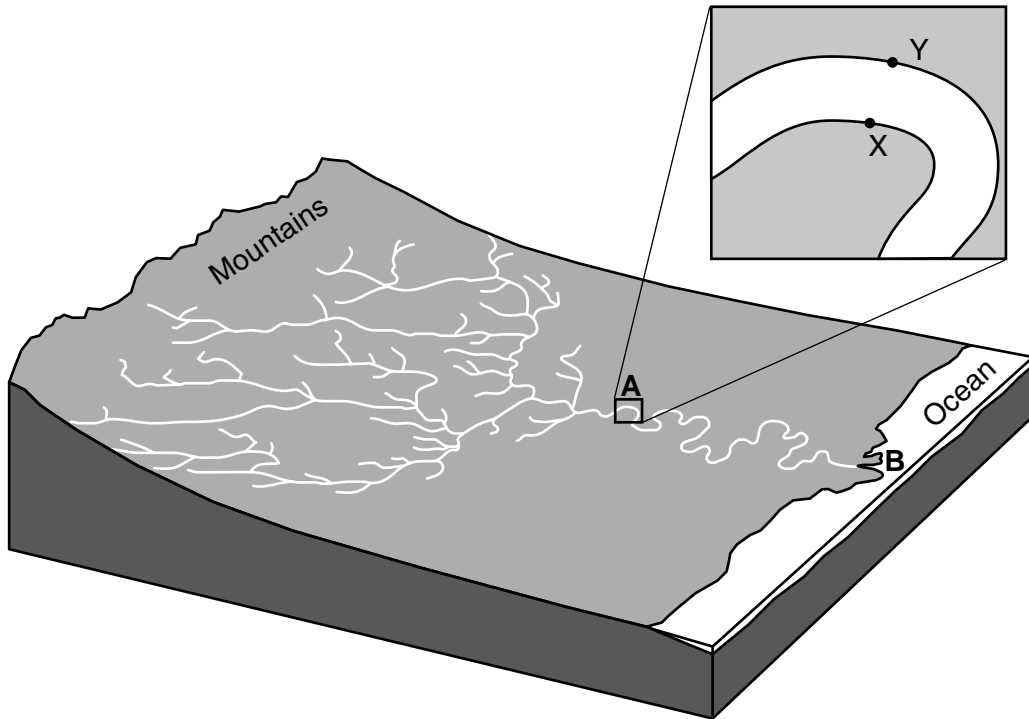
42 Which bar graph would best represent the rate of water infiltration through tubes A, B, and C?



43 These tubes are placed in water up to the level of line XY to demonstrate capillarity. After one hour, the height of the water above line XY will be

- (1) highest in tube A
- (2) highest in tube B
- (3) highest in tube C
- (4) the same height in all three tubes

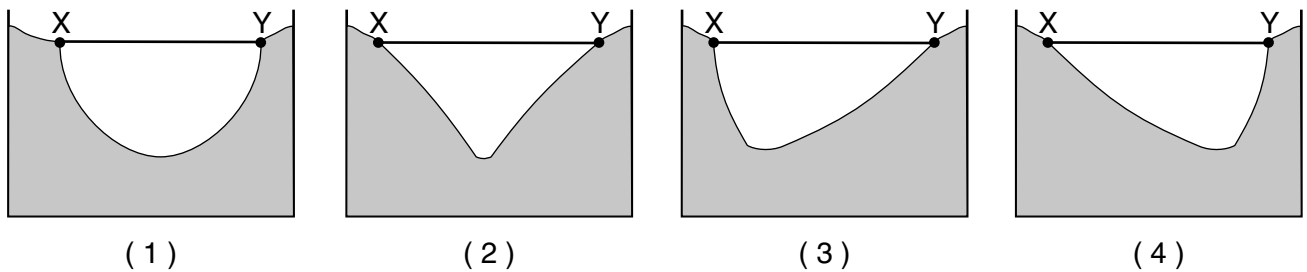
Base your answers to questions 44 through 46 on the block diagram below and on your knowledge of Earth science. The block diagram represents a river drainage system. A portion of the river, seen in box A, has been enlarged. Points X and Y are on opposite sides of the river. Letter B indicates the location where the river enters the ocean.



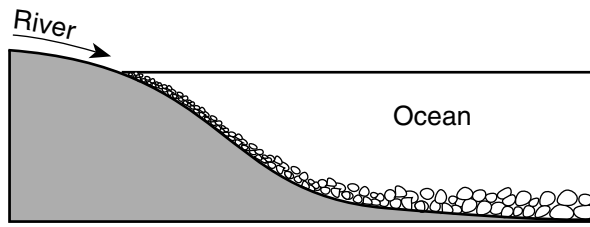
44 The area of land drained by this river and its tributaries is best described as the river's

- (1) topography
- (2) watershed
- (3) water table
- (4) floodplain

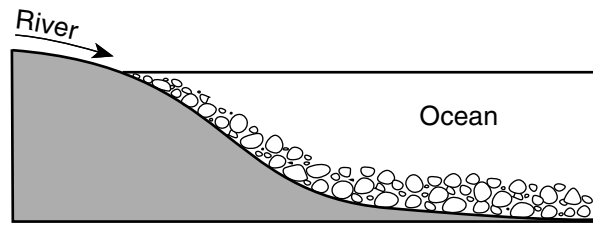
45 Which cross section best represents the profile of the bottom of the river between points X and Y at location A?



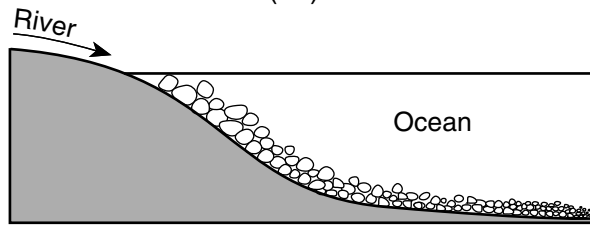
46 Which cross section represents the most likely pattern of sediments deposited where the river enters the ocean at location B?



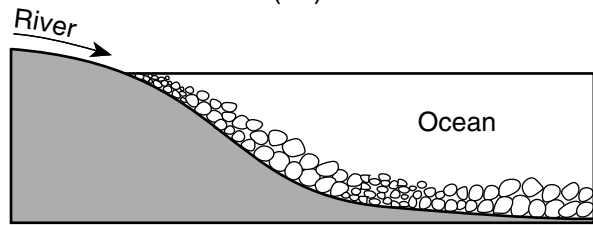
(1)



(3)

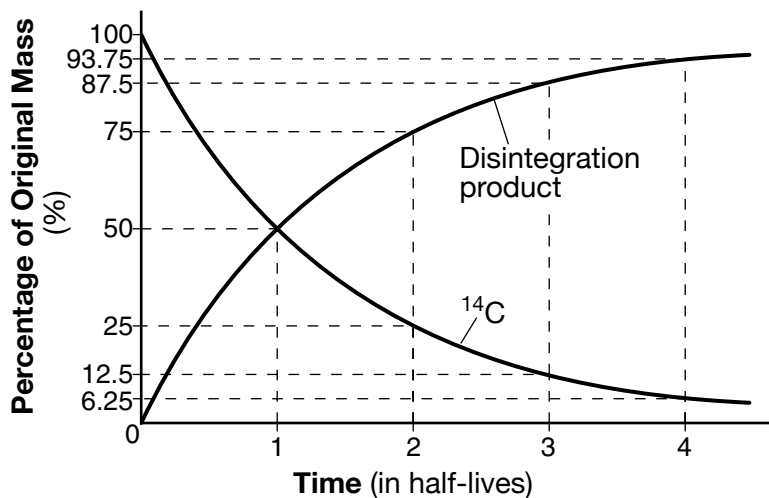


(2)



(4)

Base your answers to questions 47 through 50 on the graph below and on your knowledge of Earth science. The graph shows the percentages of the radioactive isotope carbon-14 (^{14}C) and its disintegration product produced during four half-lives of radioactive decay.



47 Radioactive carbon-14 is often useful in determining the absolute age of geologic samples because radioactive isotopes

- (1) decay at a regular rate
 (2) become less stable during decay
 (3) remain unchanged over time
 (4) stabilize after four half-lives

48 Which disintegration product is represented on the graph?

- (1) ^{206}Pb
 (2) ^{87}Sr
 (3) ^{40}Ar
 (4) ^{14}N

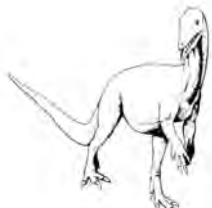
49 How many half-lives have passed if a sample contains 25% of its original carbon-14?

- (1) 1 half-life
 (2) 2 half-lives
 (3) 3 half-lives
 (4) 4 half-lives

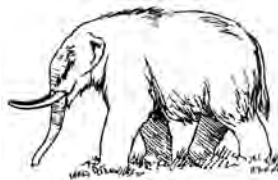
50 The age of which index fossil could be determined by using carbon-14?



(1)



(2)



(3)



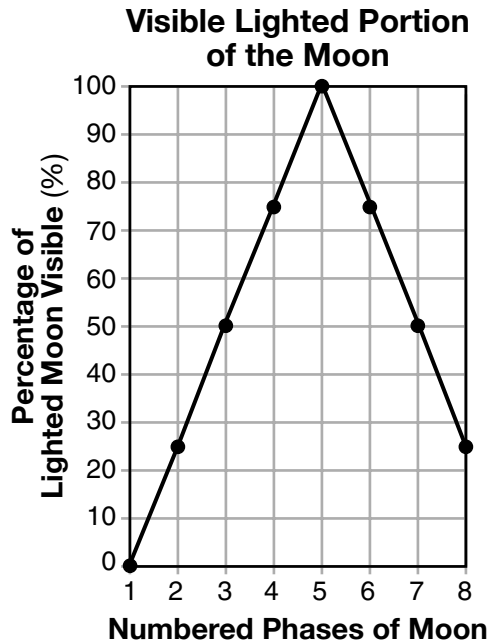
(4)

Part B–2

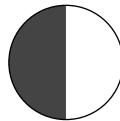
Answer all questions in this part.

Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Earth Science*.

Base your answers to questions 51 through 53 on the graph below and on your knowledge of Earth science. The graph shows the percentage of the lighted portion of the Moon that is visible to an observer in New York State through eight consecutive Moon phases.

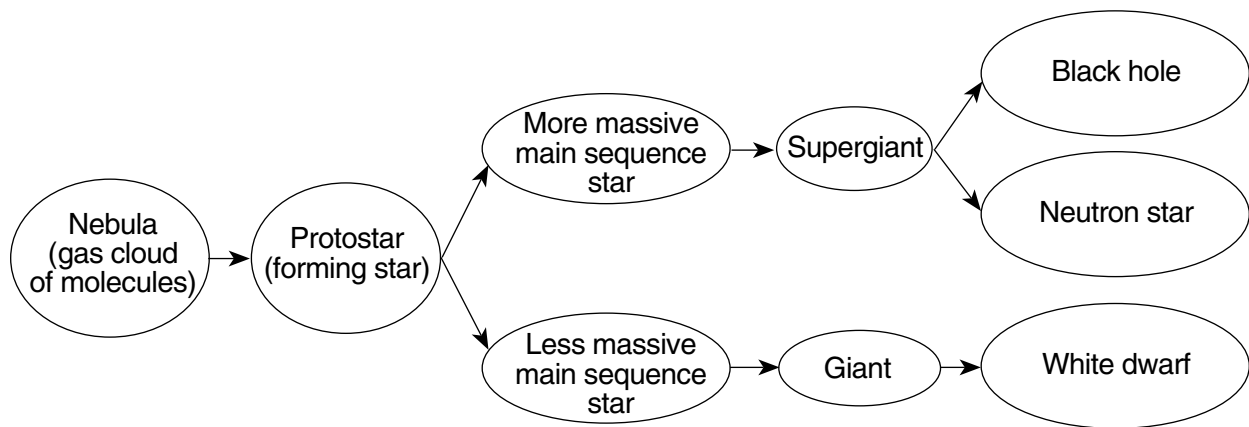


- 51 The phases of the Moon are said to be waxing when the lighted portion of the Moon gradually increases over time. Identify the numbered phase of the Moon when waxing begins and the numbered phase when waxing ends. [1]
- 52 On the diagram *in your answer booklet*, place an **X** on the Moon's orbit to represent the Moon's position at phase 5. [1]
- 53 The diagram below represents the appearance of the Moon at phase 3 as seen by an observer in New York State.



In the circle *in your answer booklet*, shade the part of the Moon that appears dark to an observer in New York State when the Moon is at phase 7. [1]

Base your answers to questions 54 through 57 on the flowchart below and on your knowledge of Earth science. The flowchart represents possible pathways in the evolution of stars.



- 54 Based on this flowchart, identify the characteristic of a main sequence star that determines whether the star becomes a giant or a supergiant. [1]
- 55 State the name of *one* star labeled on the *Characteristics of Stars* graph in the *Earth Science Reference Tables* that may become either a black hole or neutron star. [1]
- 56 Identify the nuclear process that occurs when lighter elements in a star combine to form heavier elements, producing the star's radiant energy. [1]
- 57 *In your answer booklet*, circle the relative surface temperature and relative luminosity of the main sequence star *Sirius* compared with the surface temperature and luminosity of the Sun. [1]
-

Base your answers to questions 58 through 61 on the topographic map in your answer booklet and on your knowledge of Earth science. Points *A*, *B*, *C*, and *D* represent locations on Earth's surface. Elevations are measured in meters.

- 58 On the map *in your answer booklet*, draw the 200-meter contour line in the southern portion of the map. Extend the contour line to the edges of the map. [1]
- 59 On the grid *in your answer booklet*, construct a topographic profile along line *AB* by plotting the elevation of *each* contour line that crosses line *AB*. The elevations of points *A* and *B* have been plotted on the grid. Connect *all ten* plots with a line from *A* to *B* to complete the profile. [1]
- 60 Calculate the gradient between points *C* and *D*. Label your answer with the correct units. [1]
- 61 Identify the compass direction toward which Kim Brook flows. Describe the evidence shown on the map that indicates the water flows downhill in that compass direction. [1]
-

Base your answers to questions 62 through 65 on the information below and on your knowledge of Earth science.

Adirondack Earthquake

On October 7, 1983, a magnitude 5.3 earthquake occurred in New York State's Adirondack region. The earthquake's epicenter was at Blue Mountain Lake, which is located approximately 32 miles (50 kilometers) southwest of Mt. Marcy.

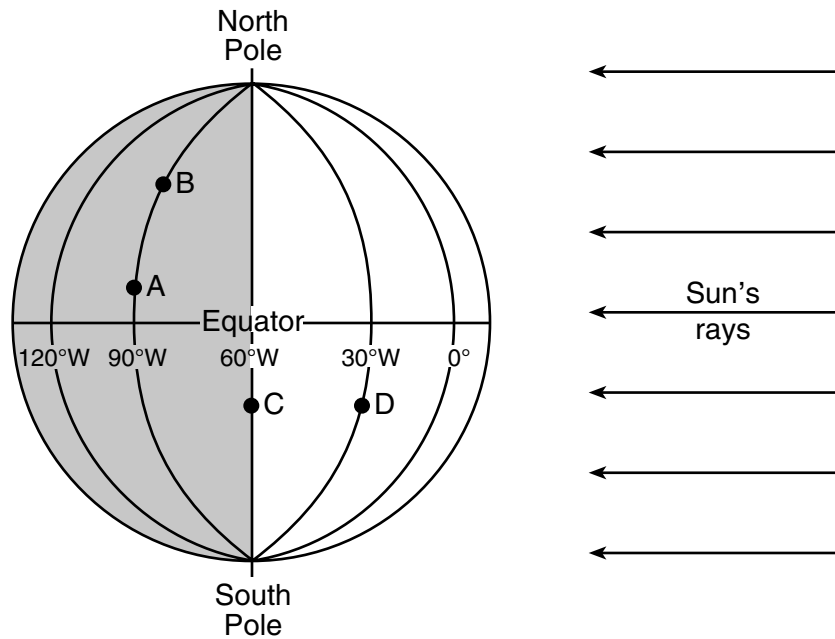
- 62 *In your answer booklet*, circle the New York State location (Old Forge *or* New York City) that recorded the greater amount of time between the arrival of the first *P*-wave and the arrival of the first *S*-wave from the Blue Mountain Lake earthquake. Explain why this location had the greater difference between the *P*-wave and *S*-wave arrival times. [1]
- 63 Determine how long it took the first *P*-wave to travel from Blue Mountain Lake to a seismic station 1200 kilometers away. [1]
- 64 Identify *one* type of metamorphic surface bedrock where this earthquake epicenter was located. [1]
- 65 Perth, Australia, is located almost directly on the opposite side of Earth from the epicenter of this earthquake. A seismograph in Perth received *P*-waves but *not* *S*-waves from this earthquake. Identify the interior layer of Earth and the characteristic of this layer that prevented the *S*-waves from arriving at Perth. [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 *2011 Edition Reference Tables for Physical Setting/Earth Science*.

Base your answers to questions 66 through 68 on the diagram below and on your knowledge of Earth science. The diagram represents Earth on the first day of a season. The equator, several lines of longitude, and the North and South Poles have been labeled. Letters A through D represent locations on Earth's surface.



- 66 Identify *one* possible date that is represented by the position of Earth in this diagram. [1]
- 67 State whether the relative altitude of *Polaris* at location A is lower or higher than at location B. Explain why this difference is observed. [1]
- 68 State the solar time at location D if the solar time at location C is 6:00 a.m. Indicate a.m. or p.m. in your answer. [1]
-

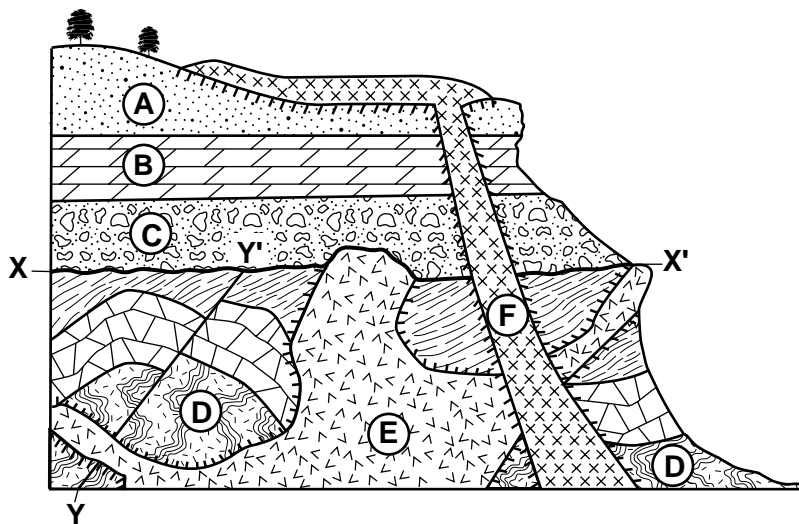
Base your answers to questions 69 through 72 on the data table below, on the map in your answer booklet, and on your knowledge of Earth science. The data table shows latitude and longitude locations of the center of Hurricane Odile recorded at the same time each day from September 12 to September 18, 2014. The data table also shows the hurricane's barometric pressure in millibars (mb) and wind speed in knots (kt). The location of La Paz, Mexico, is indicated on the map.

Hurricane Odile

Date	Location		Barometric Pressure (mb)	Wind Speed (kt)
	Latitude (° N)	Longitude (° W)		
September 12	15	105	993	50
September 13	16	106	983	65
September 14	19	107	918	120
September 15	23	110	941	110
September 16	27	113	987	55
September 17	30	114	995	40
September 18	31	112	1003	25

- 69 On the map *in your answer booklet*, plot the seven locations of Hurricane Odile indicated by the latitudes and longitudes shown in the data table. Connect *all seven* plots with a line. [1]
- 70 Using the set of axes *in your answer booklet*, draw a line to represent the general relationship between barometric pressure and wind speed associated with Hurricane Odile. [1]
- 71 Identify *one* weather instrument that was used to measure the wind speed of Hurricane Odile. [1]
- 72 Describe *two* actions that a person living in La Paz, Mexico, could take to prepare for an approaching hurricane. [1]
-

Base your answers to questions 73 through 75 on the cross section below and on your knowledge of Earth science. On the cross section, letters A through F represent rock units. Line XX' indicates an unconformity and line YY' indicates a fault. No overturning of rock layers has occurred.



Key		
Igneous Rocks		
	Diorite	
		Contact metamorphism

73 Identify the name of the rock formed in the zone of contact metamorphism between rock units A and F. [1]

74 List *two* processes that produced unconformity XX'. [1]

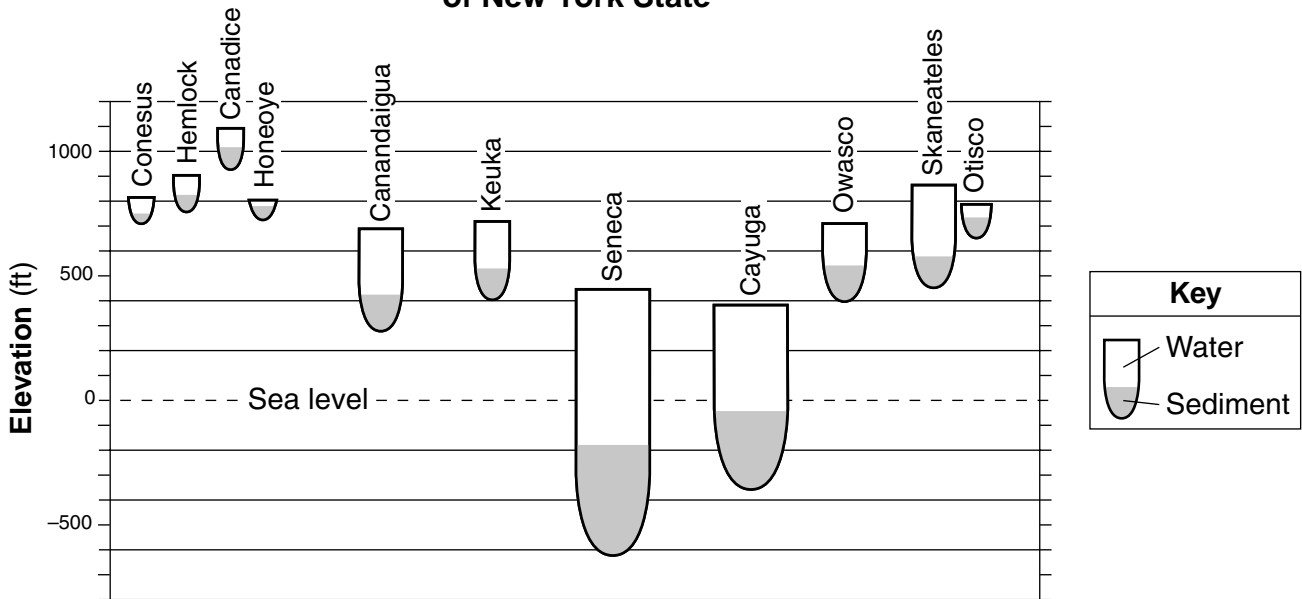
75 In your answer booklet, list the letters of rock units D, E, F, and fault YY' in the correct sequence from oldest to youngest. [1]

Base your answers to questions 76 through 79 on the passage and cross section below, and on your knowledge of Earth science. The cross section represents the elevation and depth of each Finger Lake in New York State. The gray shading in each lake represents the sediment fill at the bottom of each lake.

Formation of the Finger Lakes

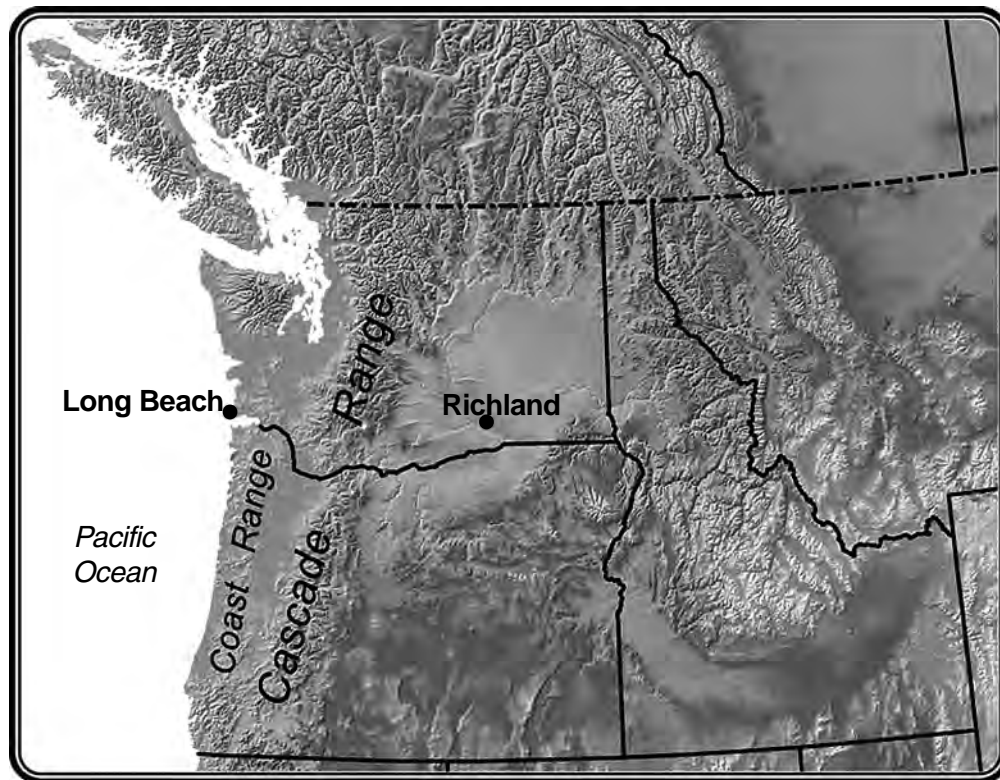
The Finger Lakes originated as a series of south-flowing rivers that existed in what is now central New York State. Around 1.7 to 1.8 million years ago, a continental glacier advanced southward, beginning an ice age that consisted of many advances and retreats of glaciers. The Finger Lakes were carved by several of these advances, which gouged the valleys of the rivers into deep troughs, some of which extend below present-day sea level. As the glaciers advanced, they pushed a great amount of soil and rock ahead of them. During the time when the ice sheets were melting and retreating, glacial moraines were left behind. These deposits dammed the glacial valleys at their southern ends, and the valleys then flooded to form the Finger Lakes.

Elevation and Maximum Depth of the Finger Lakes of New York State



- 76 Identify *one* Finger Lake that has a maximum water depth of approximately 175 feet. [1]
- 77 Identify the geologic time period and epoch when these continental glaciers formed the Finger Lakes of New York State. [1]
- 78 Describe *one* way that the arrangement of sediments in the glacial moraines is different from the arrangement of sediments deposited in the earlier river channels. [1]
- 79 Describe the cross-sectional shape of the original river valleys before they were gouged by the advancing glaciers. [1]

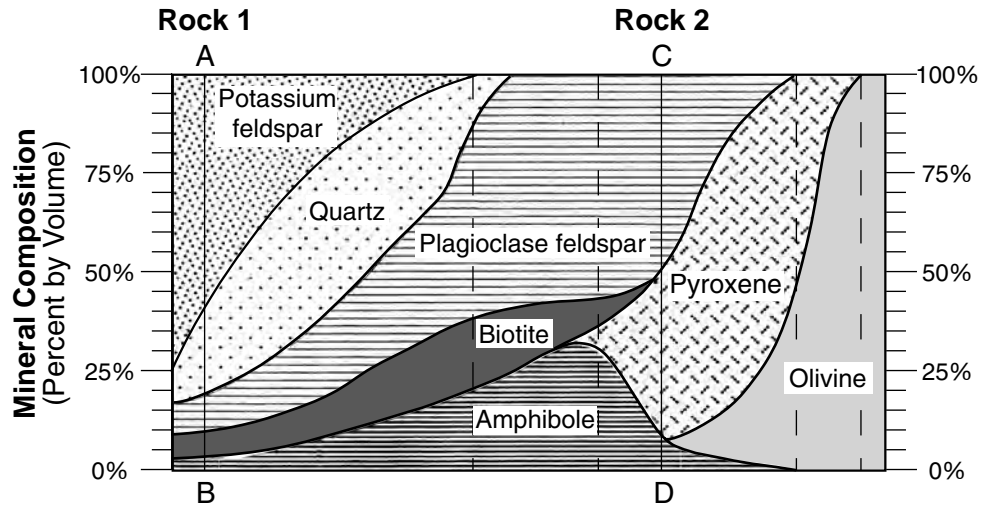
Base your answers to questions 80 and 81 on the map below and on your knowledge of Earth science. The map shows the locations of the Coast Range and Cascade Range in the Pacific Northwest of the United States and two cities in this region.



80 Identify the name of the cool surface ocean current that influences the climate of this region. [1]

81 Explain why the difference between average winter and summer temperatures is smaller in Long Beach than in Richland. [1]

Base your answers to questions 82 through 85 on the diagram below and on your knowledge of Earth science. The diagram represents a portion of the scheme for igneous rock identification. Line *AB* represents the percentages of the minerals in igneous rock 1 and line *CD* represents the percentages of the minerals in igneous rock 2.



- 82 Rock 1 is a glassy, vesicular igneous rock. Identify the name of rock 1. [1]
- 83 Compared to the color and density of igneous rock 1, describe how the relative color and density of igneous rock 2 are different. [1]
- 84 Explain why andesite and diorite can both have the same percentage of mineral composition by volume, and yet be two different igneous rocks. [1]
- 85 The table *in your answer booklet* shows the composition of three minerals commonly found in igneous rocks. Complete the table by placing *one X* in each row to indicate if that mineral is found in both rock 1 and rock 2, neither rock 1 nor rock 2, rock 1 only, or rock 2 only. [1]

PHYSICAL SETTING EARTH SCIENCE

Thursday, August 17, 2017 — 8:30 to 11:30 a.m., only

ANSWER BOOKLET

Student

Teacher

School Grade

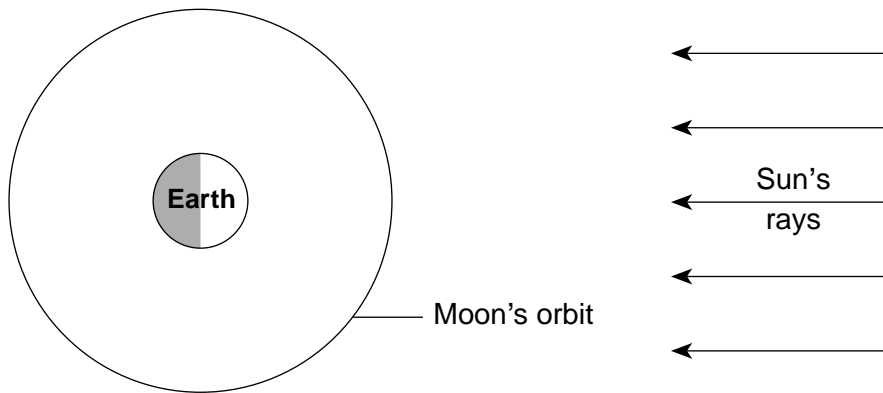
Record your answers for Part B-2 and Part C in this booklet.

Part B-2

51 Waxing begins: Phase _____

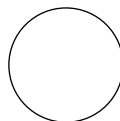
Waxing ends: Phase _____

52



(Not drawn to scale)

53



54 _____

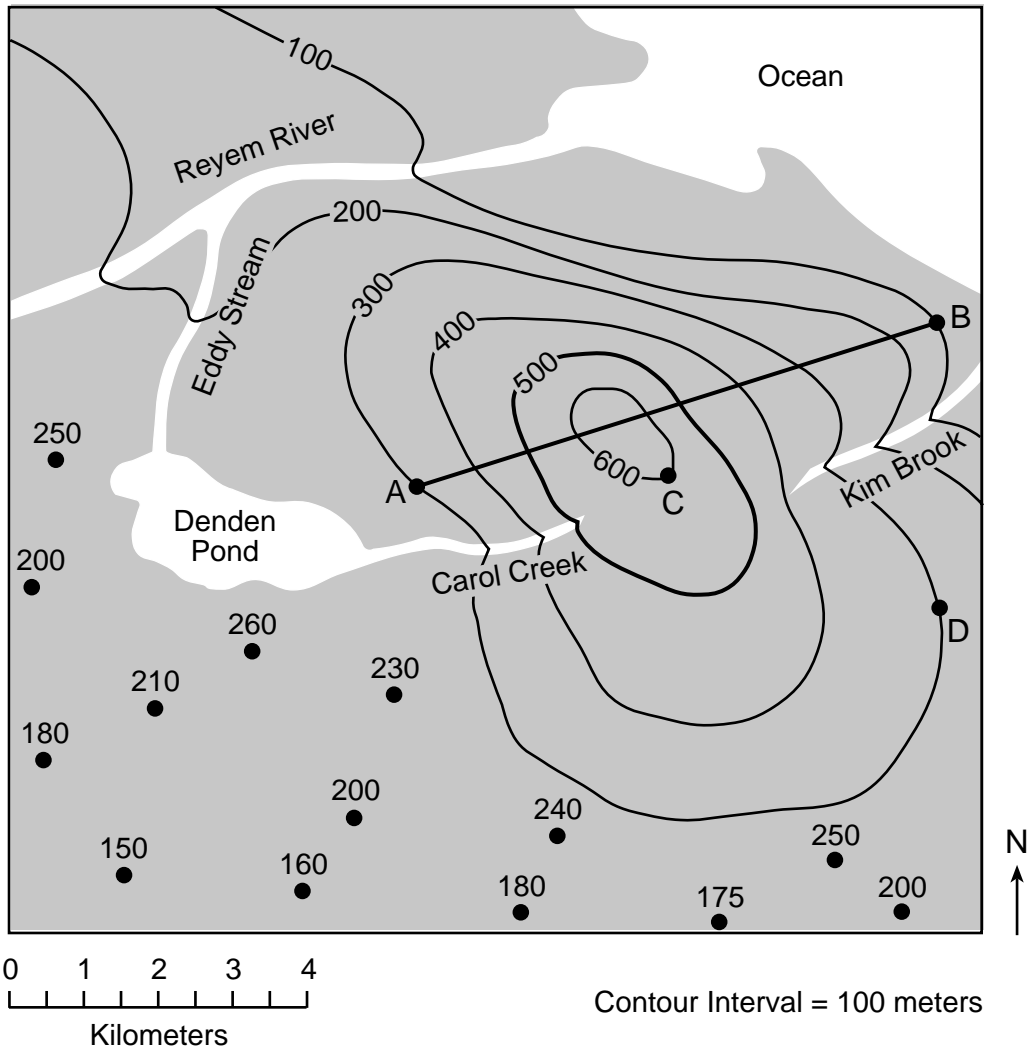
55 _____

56 _____

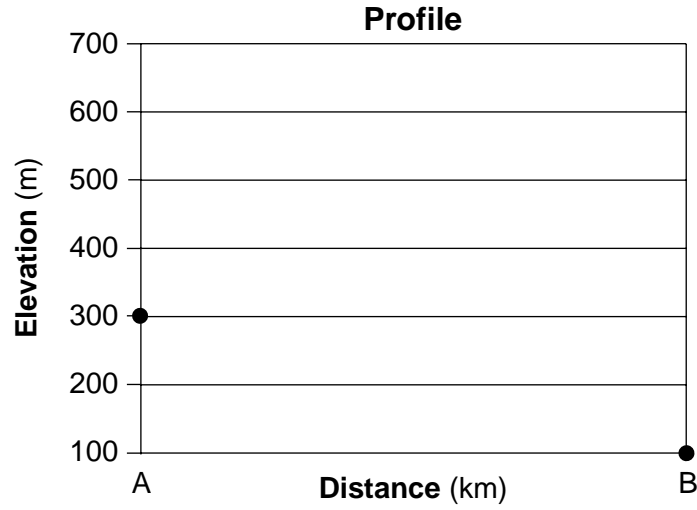
57 Relative surface temperature of *Sirius* (circle one): **lower** **higher** **the same**

Relative luminosity of *Sirius* (circle one): **less** **greater** **the same**

58



59



60 _____

61 Compass direction: _____

Evidence: _____

62 Circle one: **Old Forge** **New York City**

Explanation: _____

63 _____ **min** _____ **s**

64 _____

65 Earth's interior layer: _____

Characteristic of this layer: _____

Part C

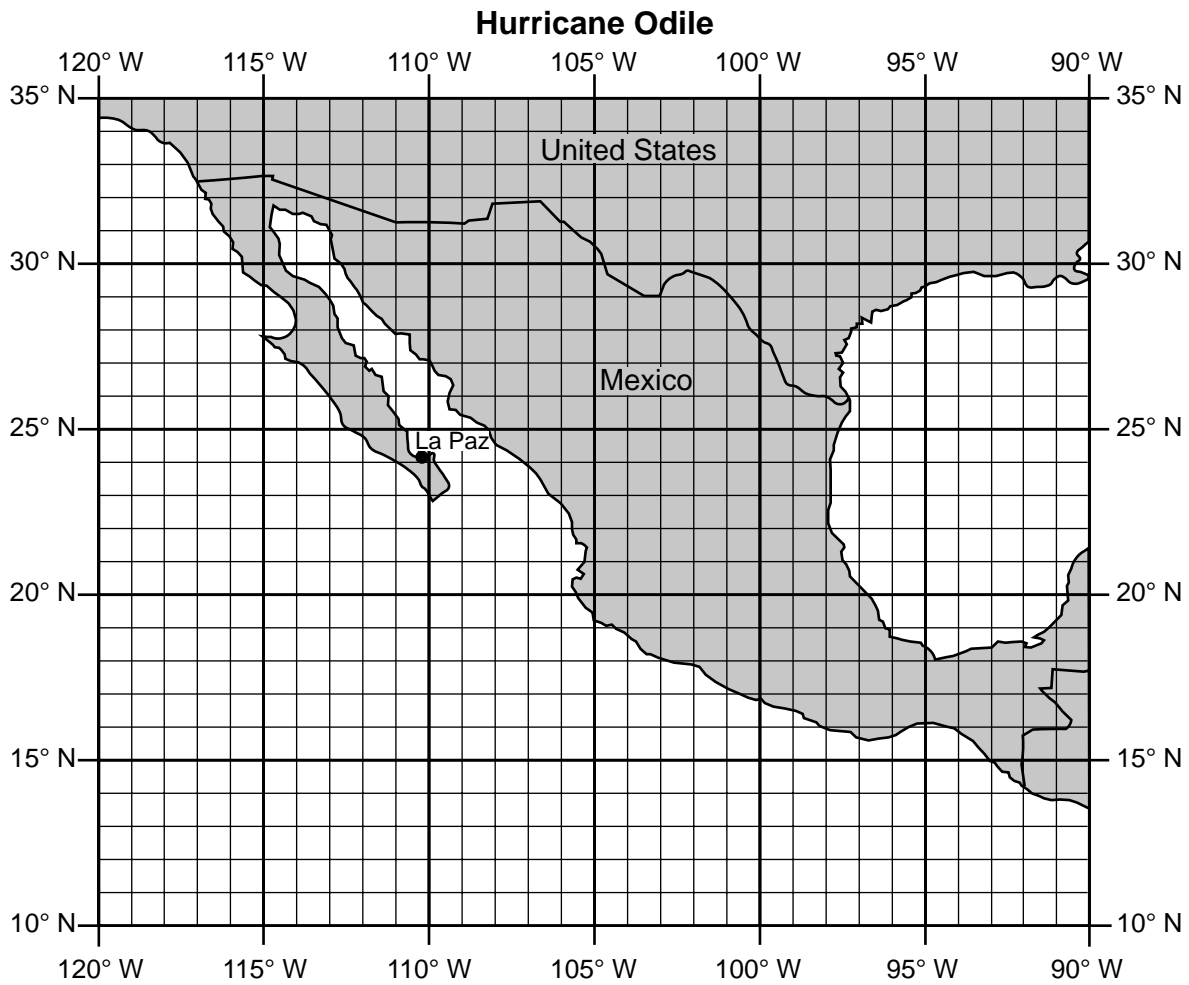
66 _____

67 Relative altitude of *Polaris* at location A: _____

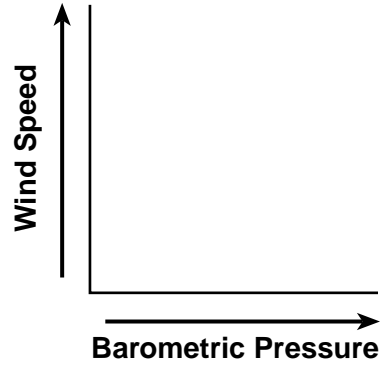
Explanation: _____

68 _____

69



70



71 _____

72 Action 1: _____

Action 2: _____

73 _____

74 Process 1: _____

Process 2: _____

75 _____ → _____ → _____ → _____
Oldest → Youngest

76 _____ **Lake**

77 _____ **Period**

_____ **Epoch**

78 _____

79 _____

80 _____ **Current**

81 _____

82 _____

83 Relative color of rock 2: _____

Relative density of rock 2: _____

84 _____

85

Mineral Composition	Found in both rock 1 and rock 2	Found in neither rock 1 nor rock 2	Found in rock 1, only	Found in rock 2, only
(Na,Ca)AlSi ₃ O ₈				
KAlSi ₃ O ₈				
(Fe,Mg) ₂ SiO ₄				

FOR TEACHERS ONLY

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

P.S.–E.S. PHYSICAL SETTING/EARTH SCIENCE

Thursday, August 17, 2017 — 8:30 to 11:30 a.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 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 at: <http://www.p12.nysed.gov/assessment/> and select the link “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 1	10 3	19 2	28 4
2 4	11 1	20 4	29 1
3 2	12 2	21 1	30 4
4 3	13 3	22 2	31 3
5 4	14 1	23 3	32 3
6 2	15 4	24 4	33 4
7 2	16 1	25 1	34 4
8 3	17 3	26 2	35 2
9 1	18 1	27 4	

Part B–1

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

Directions to the Teacher

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

Do not attempt to correct the student's work by making insertions or changes of any kind. If the student's responses for the multiple-choice questions are being hand scored prior to being scanned, the scorer must be careful not to make any marks on the answer sheet except to record the scores in the designated score boxes. Marks elsewhere on the answer sheet will interfere with the accuracy of the scanning.

Allow 1 credit for each correct response.

At least two science teachers must participate in the scoring of the Part B–2 and Part C open-ended questions on a student's paper. 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 more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

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. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the questions allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the space provided. The student's score for the Earth Science Performance Test should be recorded in the space provided. Then the student's raw scores on the written test and the performance test should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Thursday, August 17, 2017. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart may change from one administration 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 maximum of 15 credits for this part.

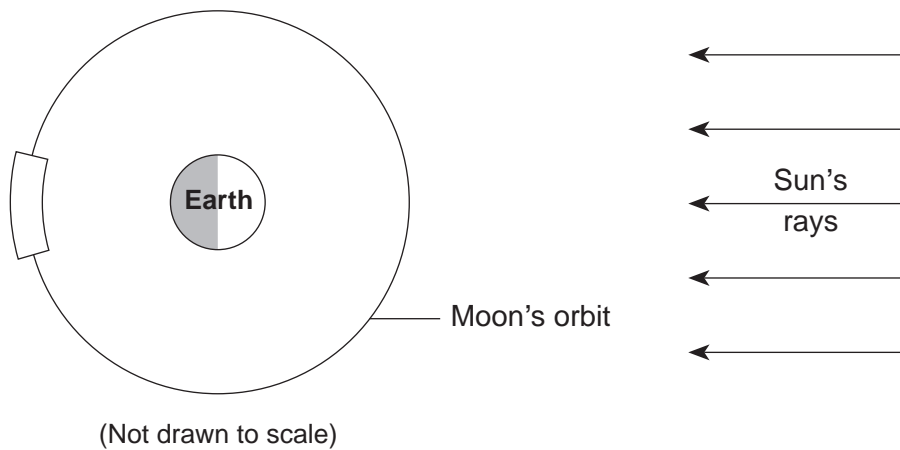
To ensure the accuracy of overlays, select a printer setting such as *full*, *actual size* or *100%* when printing this document. Do **not** select the *fit to page* setting.

51 [1] Allow 1 credit for waxing begins at Phase 1 *or* New Moon and waxing ends at Phase 5 *or* Full Moon.

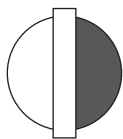
52 [1] Allow 1 credit if the center of the **X** is within or touches the clear banded region shown below.

Note: Allow credit if a symbol other than an **X** is used.

It is recommended that an overlay of the same scale as the student answer booklet be used to ensure reliability in rating.

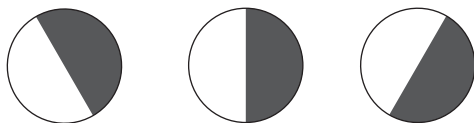


53 [1] Allow 1 credit for shading half of the circle on the right side. The edge of the shading should be within or touching the clear rectangle shown below.



Note: It is recommended that an overlay of the same scale as the student answer booklet be used to ensure reliability in rating.

Examples of 1-credit responses:



54 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- mass
- amount of matter in a star
- how massive the star is
- size

Note: Do *not* allow credit for “luminosity” because, even though luminosity is related to the mass of a star, this is not how scientists classify the life cycle of stars based on this flowchart.

55 [1] Allow 1 credit for *Rigel* or *Deneb* or *Betelgeuse* or *Spica* or *Polaris*.

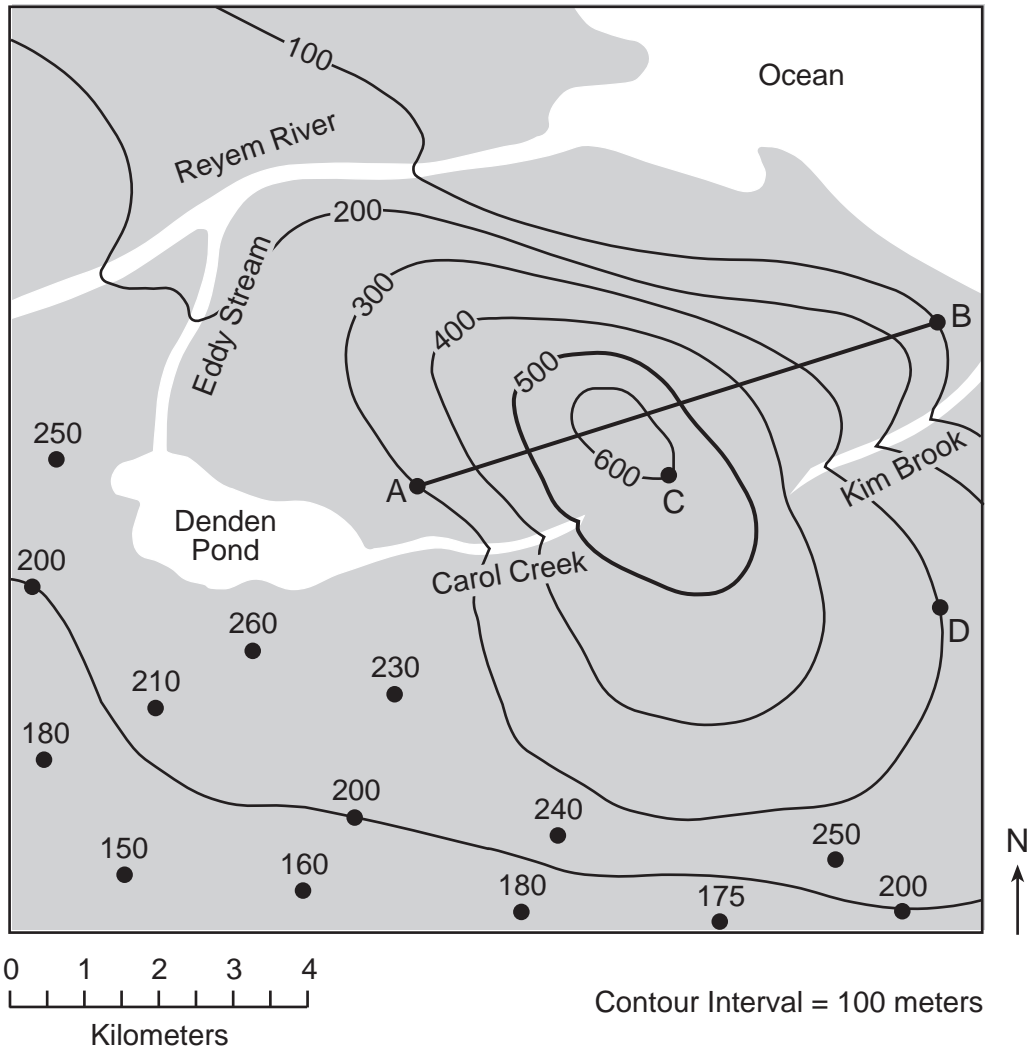
56 [1] Allow 1 credit for fusion *or* nuclear fusion.

57 [1] Allow 1 credit if *both* higher relative surface temperature and greater relative luminosity are circled.

58 [1] Allow 1 credit for correctly drawing the 200-meter contour line extended to the edges of the map.

Note: If additional contour lines are drawn, all must be drawn correctly to receive credit.

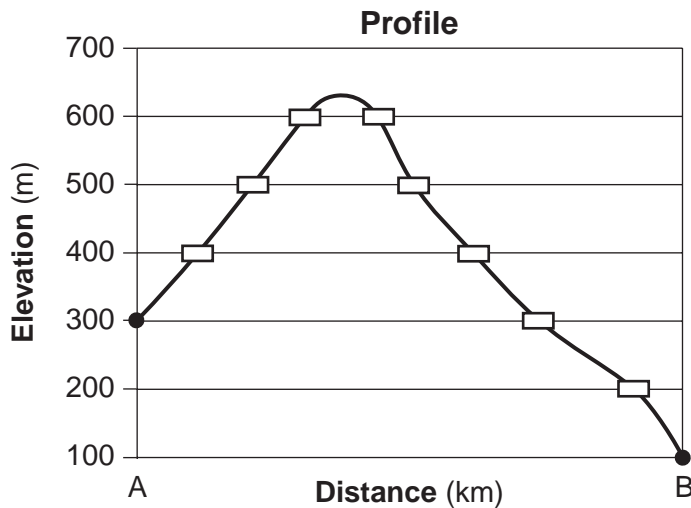
Example of a 1-credit response:



- 59 [1] Allow 1 credit if the centers of *all eight* student plots are within or touch the clear rectangles shown below and *all ten* plots are correctly connected with a line that passes within or touches the rectangles. The line must show the highest elevation above 600 m, but below 700 m.

Note: Allow credit if the line does not pass through the students plots, but is still within or touches the rectangles.

It is recommended that an overlay of the same scale as the student answer booklet be used to ensure reliability in rating.



- 60 [1] Allow 1 credit for any value from 73 to 77 or -73 to -77 with the correct units. Acceptable responses include, but are not limited to:
- m/km
 - meters/kilometers

- 61 [1] Allow 1 credit if *both* responses are correct. Acceptable responses include, but are not limited to:
- Compass direction:
- NE
 - east northeast
 - NNE
 - from SW to NE

Evidence:

- Contour lines bend upstream when they cross Kim Brook.
- Contour lines make a V shape at Kim Brook and the V points uphill.
- The brook flows out of the Vs.
- Kim Brook flows from a higher to a lower elevation.
- Elevations decrease toward the northeast.
- Kim Brook flows to sea level/the ocean.

Note: Do *not* accept “from the SW” only, because this does *not* indicate the direction *toward* which it flows.
Do *not* accept “water flows downhill” because this is given in the question.

62 [1] Allow 1 credit for *both* circling New York City and providing an acceptable explanation. Acceptable responses include, but are not limited to:

- New York City is farther from the epicenter, so there is a greater difference between the arrival of the first *P*-wave and the first *S*-wave.
- As distance to the epicenter increases, the difference in arrival times increases.
- Old Forge is closer to the epicenter near Blue Mountain Lake (*or* Mt. Marcy) so the arrival times are closer together.

Note: Allow credit if New York City is not circled, but is correctly used in the explanation.

All responses must correctly refer to the earthquake epicenter or earthquake origin to receive credit.

63 [1] Allow 1 credit for any value from 2 min 30 s to 2 min 40 s.

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

- gneiss
- quartzite
- marble
- anorthositic rocks

65 [1] Allow 1 credit for *both* outer core and an acceptable characteristic. Acceptable responses include, but are not limited to:

Characteristic of this layer:

- liquid/fluid
- molten rock
- melted iron and nickel
- temperature greater than melting point

Note: Do *not* accept “core” alone because it does not indicate the liquid part of the core.

Part C

Allow a maximum of 20 credits for this part.

66 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- March 19, 20, 21, or 22
- September 21, 22, 23, or 24
- Spring/vernal equinox
- Autumn/fall equinox
- equinox
- 3/20

67 [1] Allow 1 credit for *both* lower and an acceptable explanation. Acceptable responses include, but are not limited to:

Explanation:

- Location *A* is farther from the North Pole, where *Polaris* is directly overhead.
- Location *A* is at a lower latitude.
- closer to the equator
- As latitude decreases, altitude of *Polaris* decreases.
- Location *B* is farther north.
- altitude of *Polaris* = latitude of observer
- They are at different latitudes.

Note: Do *not* allow credit for “location *B* is closer to *Polaris*” or “location *A* is farther from *Polaris*” because all locations on Earth are essentially the same distance from *Polaris*.

68 [1] Allow 1 credit for a response that indicates a time value of 8 a.m. Acceptable responses include, but are not limited to:

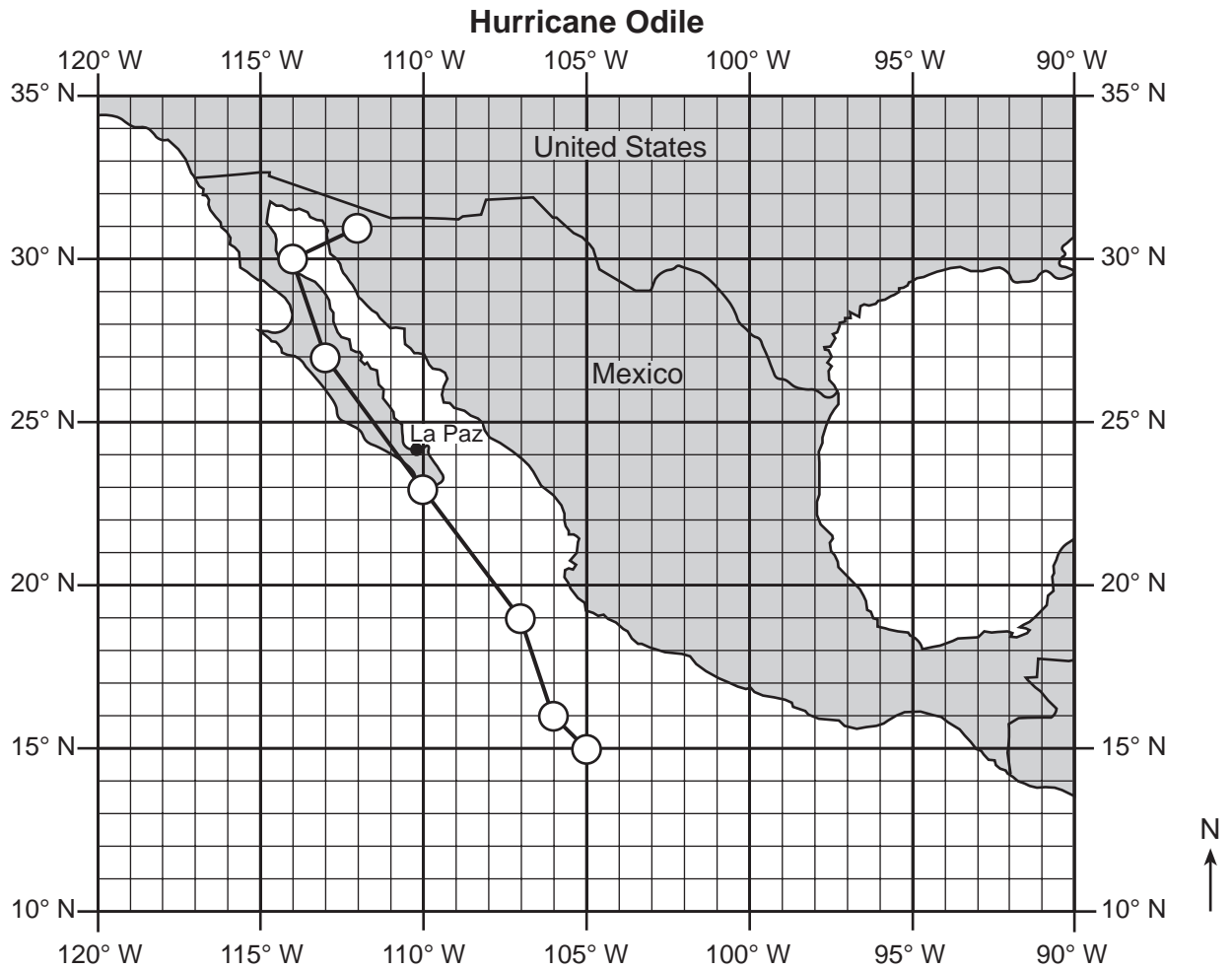
- 8:00 a.m.
- 8 a.m.
- 8 o’clock in the morning
- 0800

69 [1] Allow 1 credit if the centers of *all seven* plots are within or touch the circles shown and are correctly connected with a line that passes within or touches each circle.

Note: Allow credit if the line does *not* pass through the student's plots, but is still within or touches the circles.

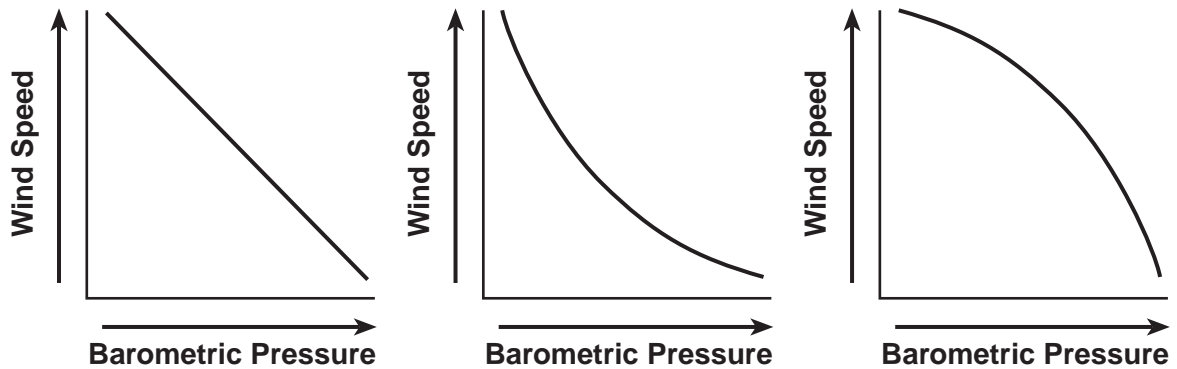
It is recommended that an overlay of the same scale as the student answer booklet be used to ensure reliability in rating.

Example of a 1-credit response:



- 70 [1] Allow 1 credit for a line that shows a negative slope. Acceptable responses include, but are not limited to:

Examples of 1-credit responses:



- 71 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- anemometer
- wind speed meter
- wind gauge
- Doppler radar/radar
- pitot tube

- 72 [1] Allow 1 credit for *two* correct actions. Acceptable responses include, but are not limited to:

- Move to an emergency shelter, shelter or bunker.
- Evacuate./Learn evacuation routes.
- Stock up on supplies of food, water, and medicine.
- Assemble an emergency kit.
- Cover windows./Board up windows.
- Secure outdoor furniture.
- Get a generator./Make sure generator is working.
- Ensure vehicle has full tank of gas.
- Charge or stock up on batteries for electronic equipment.
- Stack sandbags where needed.

73 [1] Allow 1 credit for quartzite *or* hornfels.

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

- uplift/emergence
- weathering
- erosion
- subsidence/submergence
- deposition
- burial

75 [1] Allow 1 credit for $D \rightarrow$ fault $YY' \rightarrow E \rightarrow F$.

Note: Allow credit for fault, *or* YY' alone, *or* Y alone in place of fault YY' .

Allow credit if the correct rock names are substituted for D (gneiss), E (diorite) and F (basalt).

76 [1] Allow 1 credit for Owasco Lake *or* Keuka Lake.

77 [1] Allow 1 credit for *both* the Quaternary Period and Pleistocene Epoch.

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

- Glacial moraine deposits are unsorted/mixed.
- Glacial deposits in a moraine are unlayered.
- unsorted
- River deposits are sorted.

79 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- V-shaped valleys
- narrow valley bottom with gently sloped sides

80 [1] Allow 1 credit for California Current.

81 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- The Pacific Ocean moderates the climate of Long Beach.
- Water has a higher specific heat and temperatures change more slowly.
- Long Beach is near a large body of water.
- Richland is farther inland.
- Long Beach has a marine climate, whereas Richland's is more continental.
- It is located closer to a large body of water.

82 [1] Allow 1 credit for pumice.

83 [1] Allow 1 credit if *both* responses are acceptable. Acceptable responses include, but are not limited to:

Relative color of rock 2:

- Igneous rock 2 is darker/dark.
- blacker/black
- greener/green
- Rock 1 is lighter than rock 2.

Relative density of rock 2:

- Igneous rock 2 has a higher density.
- greater
- more dense/denser
- Rock 1 is less dense than rock 2.

Note: Do *not* accept “more mafic” for either relative color or relative density of rock 2, as this refers to composition.

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

- The rocks may have different environments of formation.
- Diorite is plutonic and andesite is volcanic.
- One forms from cooling magma, and one forms from cooling lava.
- They cooled at different rates.
- They have different grain sizes or textures.
- One is extrusive and one is intrusive.
- They formed differently.

85 [1] Allow 1 credit if *all three Xs* are only placed in the correct boxes as shown below.

Note: Allow credit if a symbol other than an **X** is used.

Mineral Composition	Found in both rock 1 and rock 2	Found in neither rock 1 nor rock 2	Found in rock 1, only	Found in rock 2, only
$(\text{Na,Ca})\text{AlSi}_3\text{O}_8$	X			
KAlSi_3O_8			X	
$(\text{Fe,Mg})_2\text{SiO}_4$		X		

Regents Examination in Physical Setting/Earth Science

August 2017

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

The Chart for Determining the Final Examination Score for the August 2017 Regents Examination in Physical Setting/Earth Science will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Thursday, August 17, 2017. 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.

Online Submission of 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 <http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.cfm>.
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 2017 Physical Setting/Earth Science			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		60	69, 70
Math Key Idea 2	28	49, 51, 63	70, 76
Math Key Idea 3	28		67, 68,
Science Inquiry Key Idea 1	2, 10, 12, 26	36, 39, 47, 48, 50, 55, 56, 65	67, 71, 74, 79, 81
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3	6, 8, 9, 10, 13, 15, 17, 18, 19, 24, 25, 29, 32, 33, 34, 35	37, 38, 40, 50, 55, 57, 60, 62, 63, 64, 65	66, 73, 77, 80, 82, 83, 84, 85
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Key Idea 3			72
Standard 6			
Key Idea 1	7, 30	45	78
Key Idea 2	6, 9, 17, 20, 23, 26, 27, 30, 31, 32, 34, 35	36, 39, 41, 42, 43, 44, 45, 46, 52, 53, 54, 55, 57, 58, 59, 61, 64	66, 67, 69, 73, 75, 76, 81
Key Idea 3	1		76
Key Idea 4			
Key Idea 5	7, 16, 30	40, 43, 45, 52, 53, 62	79
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			72
Standard 4			
Key Idea 1	1, 2, 3, 4, 5, 6, 7, 26, 28, 29, 31, 32	36, 37, 39, 40, 41, 42, 43, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57	66, 67, 68, 69, 74, 75, 77, 79
Key Idea 2	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 27, 30, 34, 35	38, 44, 45, 46, 58, 59, 60, 61, 62, 63, 65	70, 71, 72, 76, 78, 80, 81
Key Idea 3	24, 25, 33	64	73, 82, 83, 84, 85
Reference Tables			
ESRT 2011 Edition (Revised)	8, 9, 10, 11, 13, 15, 18, 19, 24, 25, 29, 32, 33, 34, 35	37, 38, 48, 50, 55, 57, 60, 62, 63, 64, 65	73, 77, 80, 82, 83, 84, 85

The State Education Department / The University of the State of New York
Regents Examination in Physical Setting/Earth Science – August 2017
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 66 would receive a final examination score of 86.

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

**Final Examination Scores
 Regents Examination in Physical Setting/Earth Science – August 2017 – continued**

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