

PHYSICAL SETTING EARTH SCIENCE

Friday, January 25, 2019 — 9:15 a.m. to 12:15 p.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.

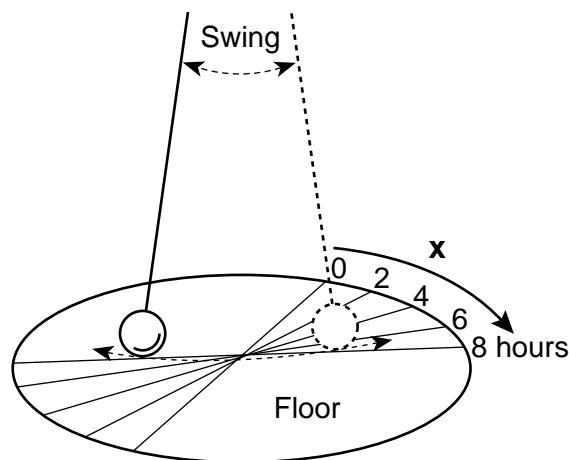
Part A

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.

- The gravitational attraction between two objects in the solar system is greatest when their masses are
 - small, and the objects are close together
 - small, and the objects are far apart
 - large, and the objects are far apart
 - large, and the objects are close together
- Cosmic background radiation detected from all directions in space provides evidence for the
 - greenhouse effect
 - Doppler effect
 - geocentric theory
 - Big Bang theory
- Which characteristic is directly related to a planet's average distance from the Sun?
 - period of revolution
 - period of rotation
 - eccentricity of orbit
 - equatorial diameter
- The frequency of Earth's cycle of ocean tides is primarily controlled by
 - Earth's rotation and the Moon's rotation
 - Earth's rotation and the Moon's revolution
 - Earth's revolution and the Moon's rotation
 - Earth's revolution and the Moon's revolution
- What is the approximate altitude of *Polaris* when viewed from New York City?
 - 90°
 - 74°
 - 49°
 - 41°

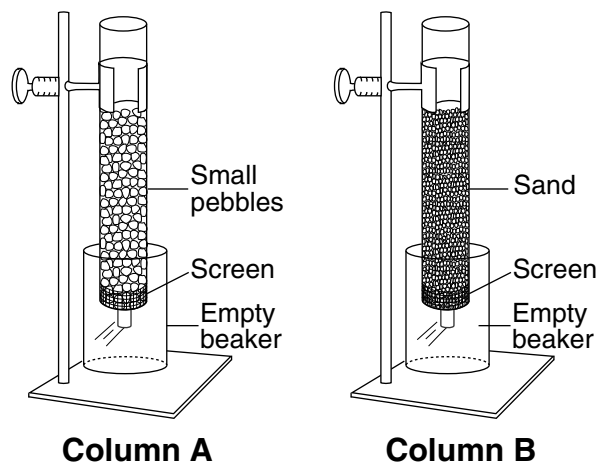
- The diagram below represents a large Foucault pendulum that has been in motion over an 8-hour period. The arrow labeled *X* represents the apparent change in the direction of swing over time.



This apparent change in the direction of swing is evidence that Earth

- is tilted on its axis
 - rotates on its axis
 - revolves in an elliptical orbit
 - has magnetic poles that reverse over time
- Which observation provides the best evidence that Earth orbits the Sun?
 - The Sun has a cyclic pattern of sunspot events.
 - The Sun appears to rise and set in a cyclic pattern.
 - The constellations that can be seen at night from Earth change with the seasons.
 - The constellations appear to move in a circular pattern around Earth.

8 The diagram below represents two columns, A and B, that were used to determine the infiltration rate and water retention of two different particle sizes by pouring equal amounts of water through each column.



(Not drawn to scale)

Compared to column A, column B had a

- (1) lower rate of infiltration and retained less water
- (2) lower rate of infiltration and retained more water
- (3) higher rate of infiltration and retained less water
- (4) higher rate of infiltration and retained more water

9 Which *two* factors will increase the rate of a stream's flow?

- (1) decreased precipitation and decreased slope
- (2) decreased precipitation and increased slope
- (3) increased precipitation and decreased slope
- (4) increased precipitation and increased slope

10 Which condition normally lowers the water table?

- (1) irrigation of fields for several weeks, using well water
- (2) several days of moderate rainfall
- (3) streambanks overflowing during spring runoff
- (4) several days of heavy snowfall, followed by rain

11 What is the dewpoint when the air temperature is 28°C and the relative humidity is 47%?

- (1) 8°C
- (2) 13°C
- (3) 16°C
- (4) 19°C

12 Clouds are formed when moist, rising air

- (1) contracts and cools, and water vapor condenses
- (2) contracts and warms, and water evaporates
- (3) expands and cools, and water vapor condenses
- (4) expands and warms, and water evaporates

13 Specific heat is used to explain why different substances

- (1) sink or float in water
- (2) change temperature at different rates
- (3) vaporize or condense at different temperatures
- (4) melt and freeze at the same temperature

14 What is the approximate percentage of Earth's history during which humans have existed, compared to the age of Earth?

- (1) 0.04%
- (2) 1.79%
- (3) 4.65%
- (4) 8.32%

15 Which two mantle hot spots are located at mid-ocean ridges?

- (1) Iceland and Yellowstone
- (2) Galapagos and Tasman
- (3) St. Helena and Hawaii
- (4) Easter Island and Bouvet

16 Approximately how many million years ago (mya) were all of Africa and South America inferred to be located south of the equator?

- (1) 59 mya
- (2) 119 mya
- (3) 232 mya
- (4) 359 mya

17 Which fossil has *not* been found in the New York State rock record?

- (1) Silurian eurypterids
- (2) Triassic dinosaur footprints
- (3) Permian trilobites
- (4) Pleistocene mastodont bones

18 What are the inferred pressure and interior temperature at the boundary between Earth's outer core and inner core?

- (1) 3.1 million atmospheres pressure and an interior temperature of 6300°C
- (2) 3.1 million atmospheres pressure and an interior temperature of 6700°C
- (3) 3.6 million atmospheres pressure and an interior temperature of 6300°C
- (4) 3.6 million atmospheres pressure and an interior temperature of 6700°C

19 The photograph below shows parallel scratches on the surface of limestone bedrock near Rochester, New York.



<https://www.flickr.com>

10 cm

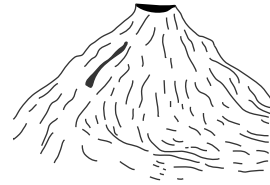
These parallel scratches were most likely caused by

- (1) ocean waves
- (2) running water
- (3) movement of glacial ice
- (4) sandblasting by wind

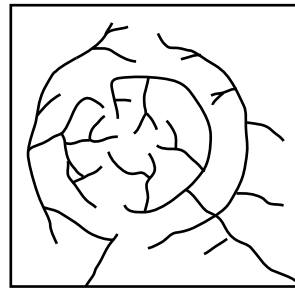
20 Landscapes with a faulted and folded surface bedrock structure, steep slopes, and high elevations are classified as

- (1) mountains
- (2) lowlands
- (3) plains
- (4) plateaus

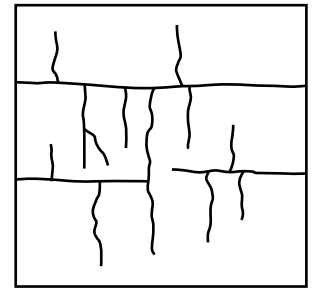
21 The diagram below represents a volcano.



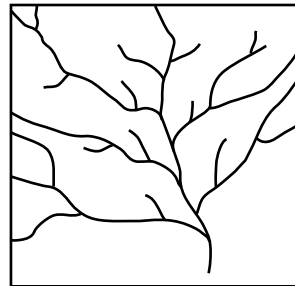
Which stream drainage pattern would most likely form on the entire surface of this volcano?



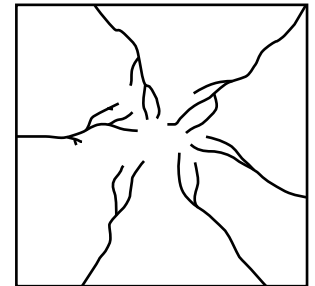
(1)



(3)



(2)

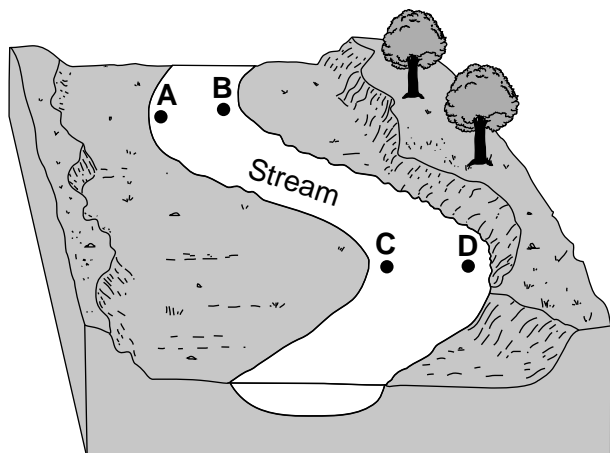


(4)

22 What is the largest particle size that a stream can transport at a velocity of 5 centimeters per second?

- (1) cobble
- (2) pebble
- (3) sand
- (4) silt

23 The diagram below represents a portion of a meandering stream. Letters A, B, C, and D represent locations on the bottom of the stream.



At which two locations would the stream most likely be the deepest?

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

24 The mineral anorthite is typically white to gray in color, has a hardness of 6.0, cleaves in two directions, and is used in making glass and ceramics. Which mineral has properties most similar to anorthite?

- (1) quartz
- (2) calcite
- (3) pyroxene
- (4) plagioclase feldspar

25 What is the texture of inorganic land-derived sedimentary rocks?

- (1) bioclastic
- (2) crystalline
- (3) clastic
- (4) vesicular

26 Which rock will weather at the fastest rate when exposed to acid rain?

- (1) granite
- (2) limestone
- (3) gneiss
- (4) quartzite

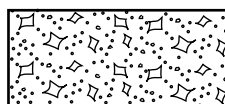
27 The photograph below shows the mineral muscovite mica.



Which physical property can be observed in this photograph?

- (1) cleavage
- (2) hardness
- (3) magnetism
- (4) streak

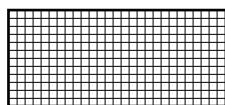
28 Which map symbol is used to represent rock that formed as a result of the evaporation of seawater?



(1)



(3)



(2)

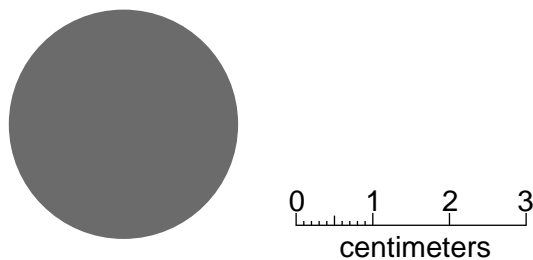


(4)

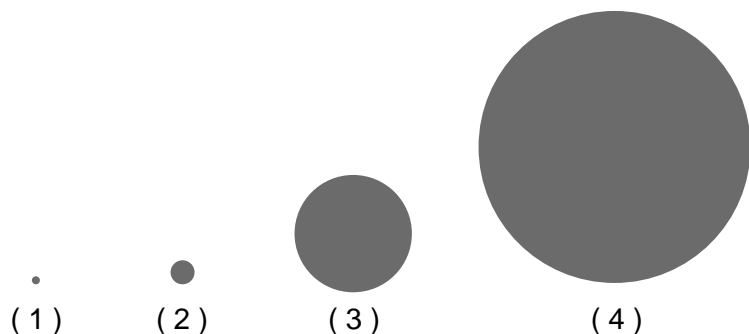
29 At which New York State location can intensely metamorphosed surface bedrock be found?

- (1) Rochester
- (2) Old Forge
- (3) Slide Mountain
- (4) Utica

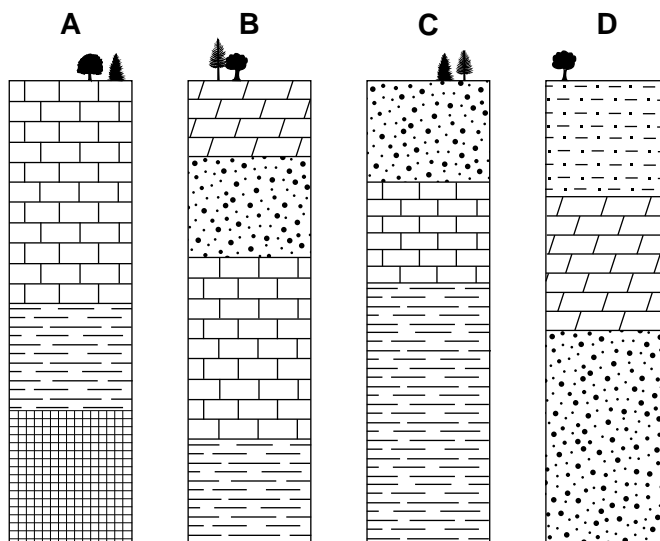
30 The diagram below represents a model of the planet Saturn drawn to a scale of 1 centimeter = 40,000 kilometers.



Which diagram best represents Earth drawn to this same scale?



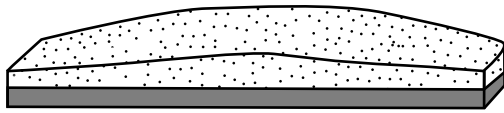
31 Columns A, B, C, and D below represent outcrops, of the same sequence of bedrock layers, found within 20 miles of each other. The rock layers have *not* been overturned.



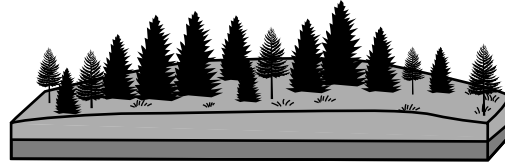
Which surface bedrock is youngest in age?

- (1) siltstone
- (2) dolostone
- (3) limestone
- (4) sandstone

32 The block diagrams below represent two large regions on Earth's surface.



White Sandy Region

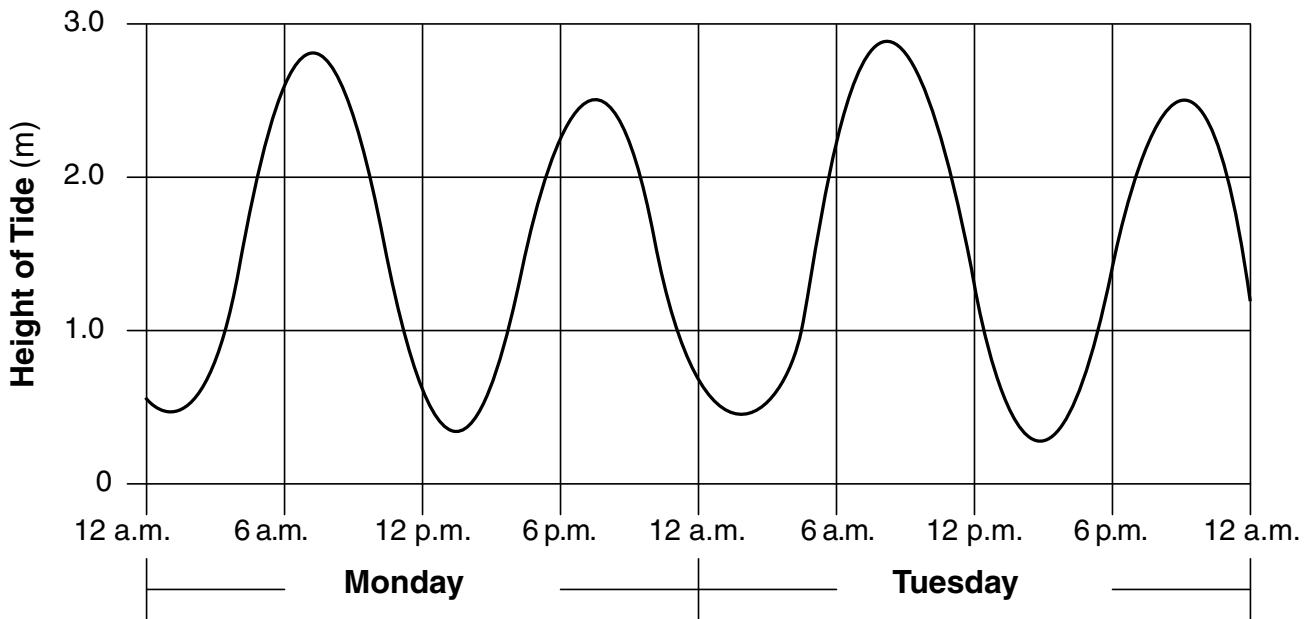


Vegetative Region

Compared to the white sandy region, the vegetative region is

- (1) less humid and absorbs less insolation
- (2) less humid and absorbs more insolation
- (3) more humid and absorbs less insolation
- (4) more humid and absorbs more insolation

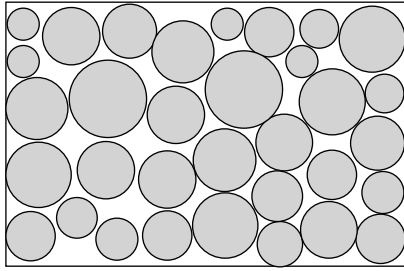
33 The graph below shows the change in the heights of tides for two days.



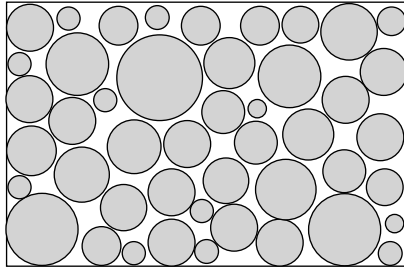
If this pattern continues, during the first six hours on Wednesday, tidal height will

- (1) decrease, only
- (2) decrease, then increase
- (3) increase, only
- (4) increase, then decrease

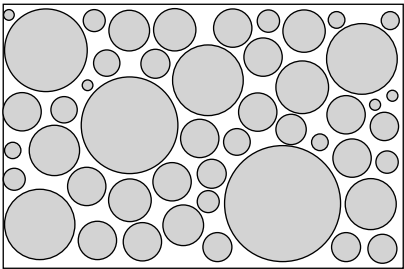
34 Which diagram best represents sediments with the greatest degree of sorting by size?



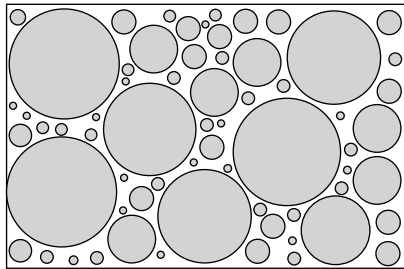
(1)



(3)



(2)



(4)

35 The photograph below shows a depositional feature located near the shore of Texas. Letter *X* represents a location on this feature.



www.texasbeyondhistory.net

On which depositional feature is location *X* found?

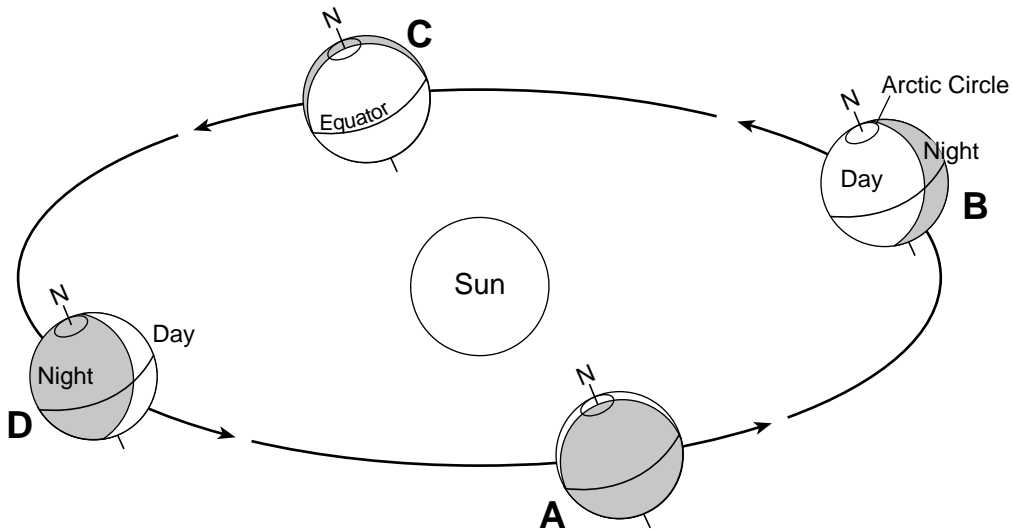
- | | |
|----------------------|------------------|
| (1) an island arc | (3) a drumlin |
| (2) a barrier island | (4) a floodplain |
-

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 diagram below and on your knowledge of Earth science. The diagram represents Earth's orbit around the Sun. Positions A, B, C, and D represent Earth's location on the first day of each season. Letter N indicates the North Pole.



(Not drawn to scale)

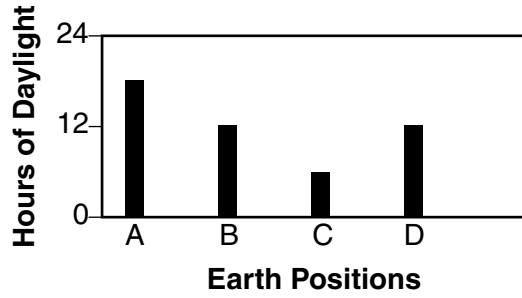
36 At each position in Earth's orbit, the North Pole is pointing toward

- (1) *Pollux*
- (2) the Sun
- (3) *Polaris*
- (4) the Moon

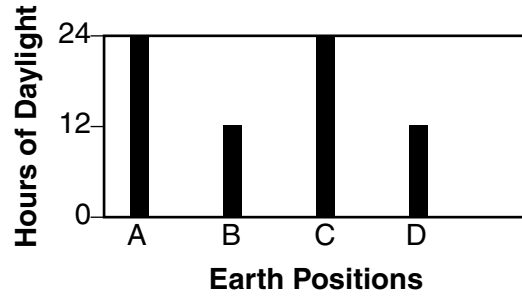
37 Earth revolves around the Sun at the rate of approximately

- (1) 1° per day
- (2) 360° per day
- (3) 15° per hour
- (4) 23.5° per hour

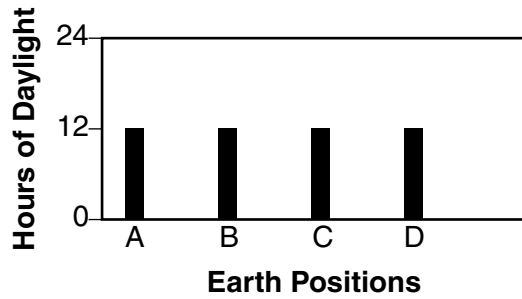
38 Which graph best shows the hours of daylight that occur at the equator on all four Earth positions shown?



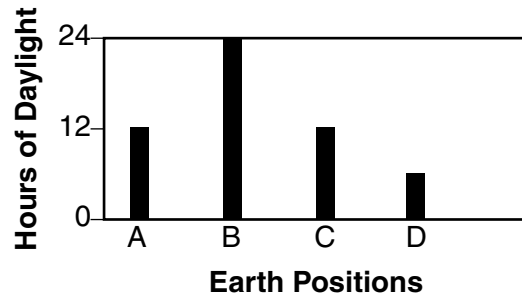
(1)



(3)

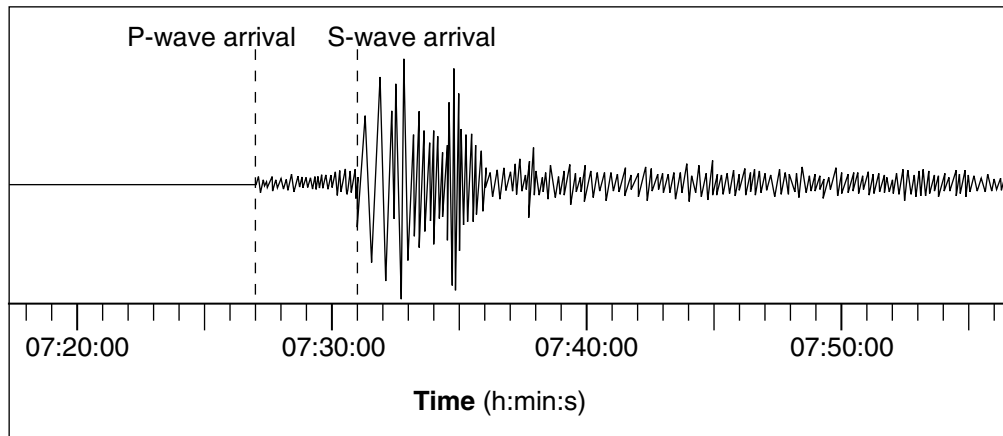


(2)



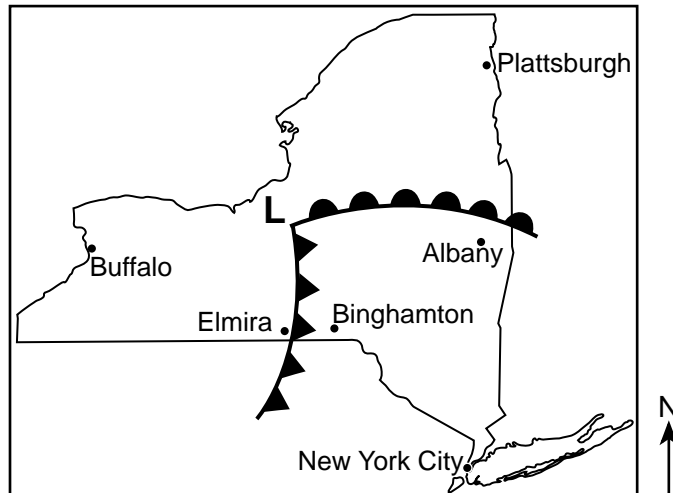
(4)

Base your answers to questions 42 and 43 on the seismogram below and on your knowledge of Earth science.



- 42 Which statement best describes the arrival of *P*-waves and *S*-waves recorded at a station located closer to the epicenter of this same earthquake?
- (1) The time difference between the arrival of the first *P*-wave and *S*-wave would be less than 4 minutes.
 - (2) The time difference between the arrival of the first *P*-wave and *S*-wave would be greater than 4 minutes.
 - (3) *P*-waves would be recorded, but no *S*-waves would arrive.
 - (4) *S*-waves would be recorded, but no *P*-waves would arrive.
- 43 The rock movement that caused the earthquake occurred 10 kilometers below Earth's surface. In which Earth layer did this earthquake originate?
- (1) lithosphere
 - (2) asthenosphere
 - (3) stiffer mantle
 - (4) outer core
-

Base your answers to questions 44 through 46 on the weather map below and on your knowledge of Earth science. The weather map shows a low-pressure system over New York State on a July day. The **L** represents the center of the low, and two fronts extend from this center. Locations of some cities are indicated.



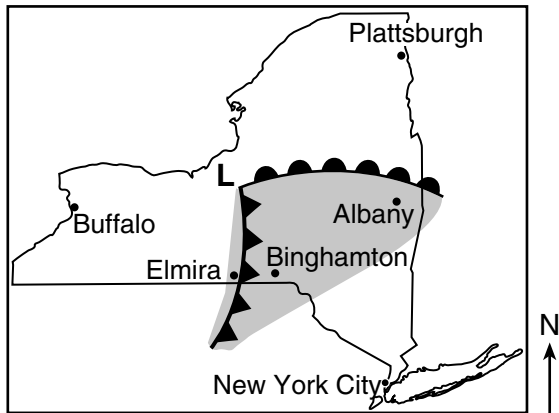
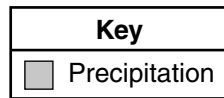
44 If the center of the low-pressure system follows a normal storm track, toward which city would the center of this low most likely move?

- (1) Buffalo
- (2) Elmira
- (3) New York City
- (4) Plattsburgh

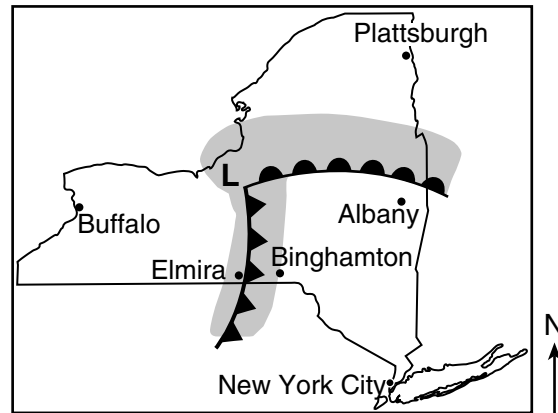
45 Severe weather was occurring in Elmira, New York. Which present weather symbol was most likely recorded on the station model for Elmira?

- (1) ●
- (2) =
- (3) △
- (4) ∞

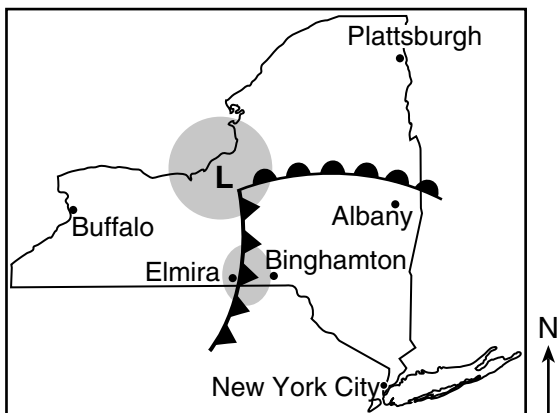
46 Which map shows the most probable areas of precipitation that would appear on a radar image taken at the time of these frontal positions?



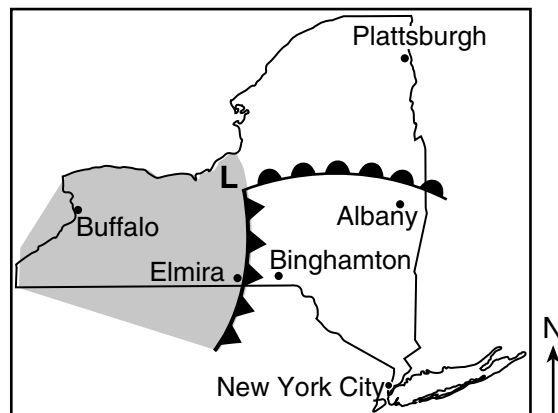
(1)



(3)

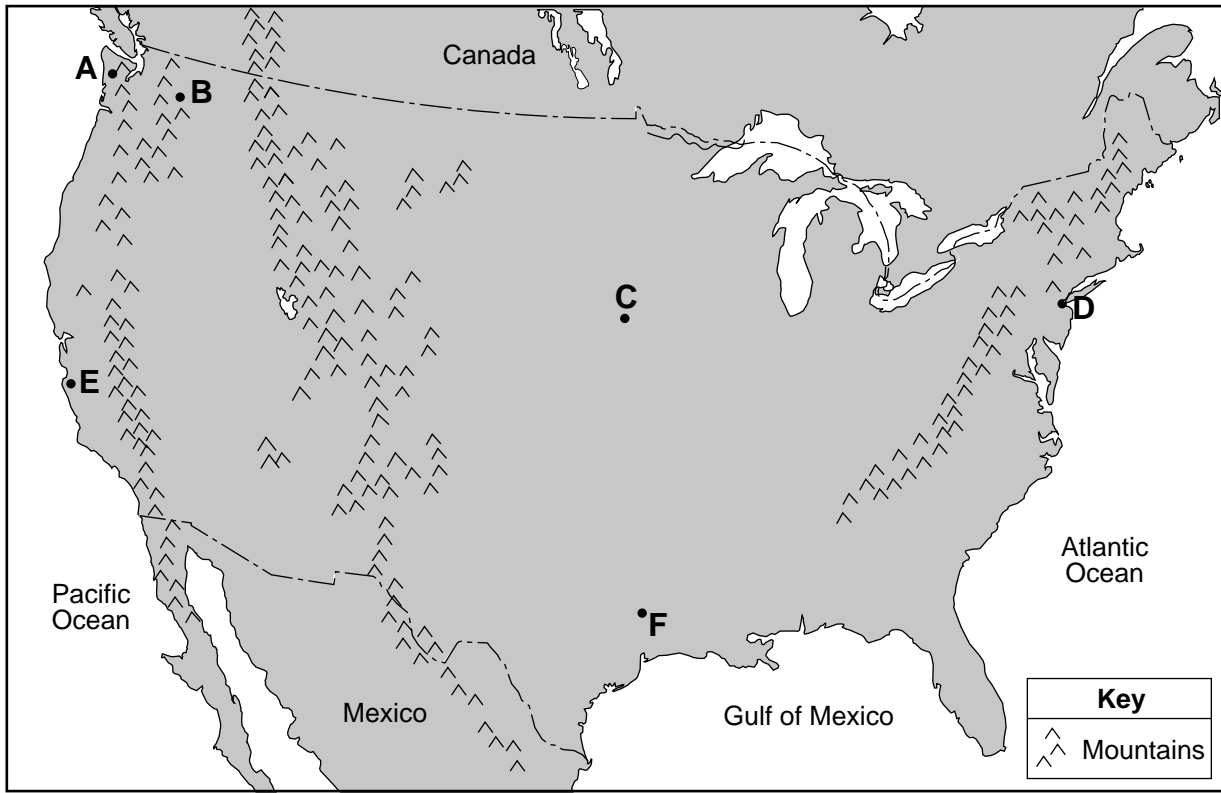


(2)



(4)

Base your answers to questions 47 through 50 on the map below and on your knowledge of Earth science. The map shows the continental United States and parts of Mexico and Canada. Letters A through F represent surface locations.



47 The climate of location A is more humid than location B because A is

- (1) at a lower elevation
- (2) at a higher latitude
- (3) on the side of a mountain range facing the prevailing wind
- (4) receiving a greater amount of energy from the Sun

48 Compared to the annual range in temperatures at location C, the annual range in temperatures at location D will be

- (1) less, because D is located near a large body of water
- (2) less, because D is located at a greater longitude
- (3) greater, because D is located near a large body of water
- (4) greater, because D is located at a greater longitude

49 The table below compares the average annual temperature for locations *C* and *F*.

Location	Average Annual Temperature
C	55°F
F	68°F

The best explanation for this temperature difference is that location *C*

- (1) is in the polar NE wind belt
- (2) is farther from the equator
- (3) has less cloud cover
- (4) has more frequent tornadoes

50 What is the relative temperature and name of the surface ocean current that affects the climate of location *E*?

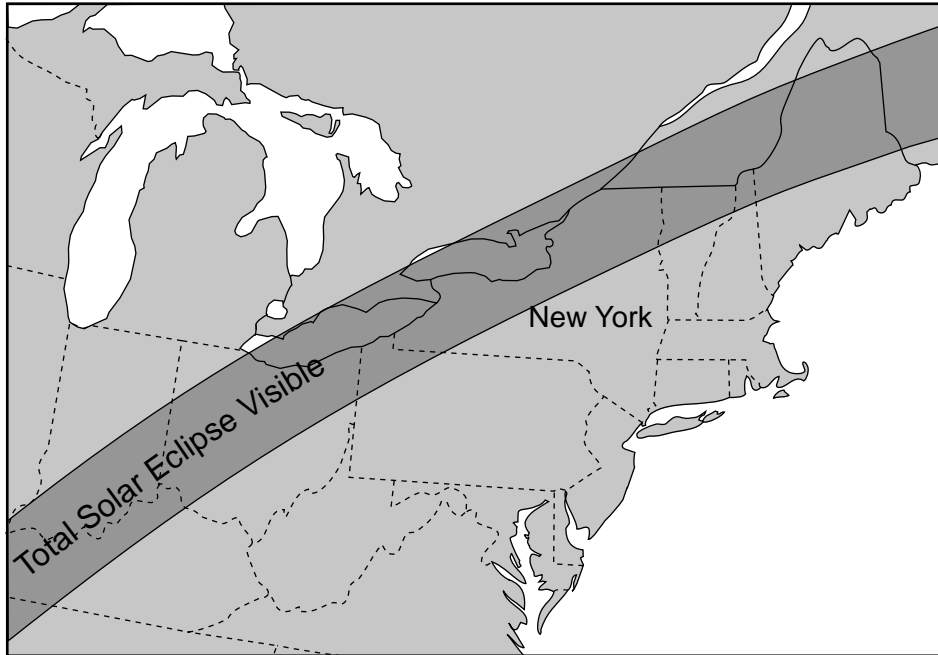
- (1) warm Alaska Current
 - (2) warm Gulf Stream Current
 - (3) cool Peru Current
 - (4) cool California Current
-

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 and 52 on the map and photograph below and on your knowledge of Earth science. The map shows a path across northeastern North America, where a total solar eclipse will be visible on April 8, 2024. The photograph shows an example of a total solar eclipse.



Total Solar Eclipse

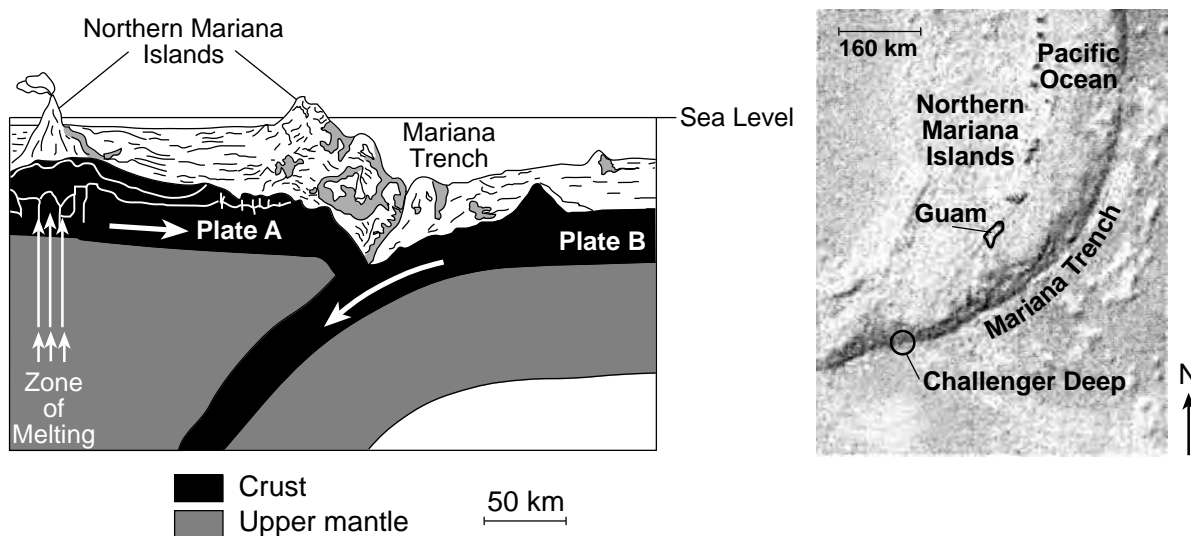


- 51 On the chart *in your answer booklet*, place a check mark (✓) in the box next to each New York State location where a total solar eclipse will be visible with clear skies on April 8, 2024. [1]
- 52 On the diagram *in your answer booklet*, place an **X** on the Moon's orbit to indicate the Moon's position during the solar eclipse on April 8, 2024. [1]

Base your answers to questions 53 through 56 on the passage, cross section, and map below and on your knowledge of Earth science. The cross section represents the relative movement of two tectonic plates, labeled A and B, at the Mariana Trench. Arrows in the plates indicate the direction of this movement.

Challenger Deep

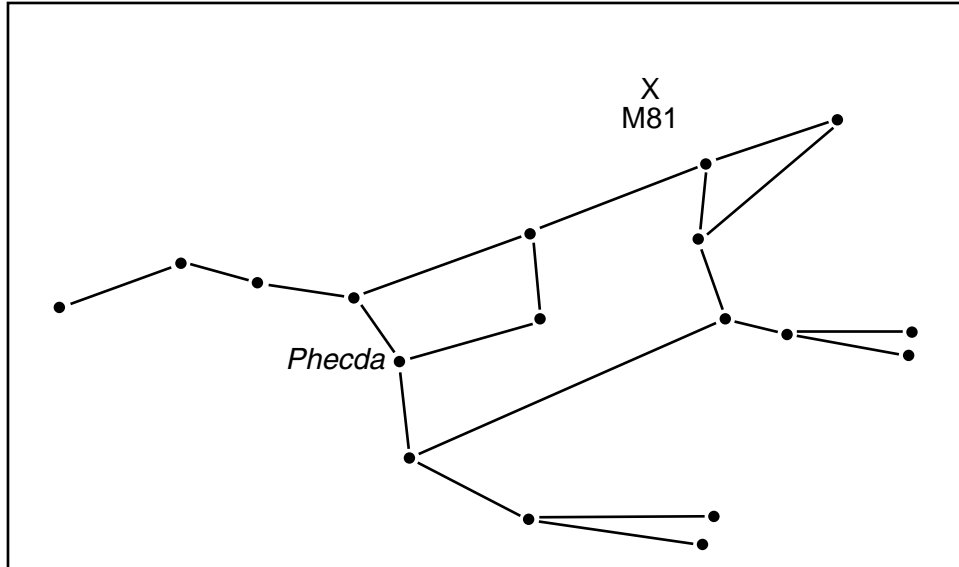
Challenger Deep is the deepest known point in Earth's oceans. This relatively narrow depression, only 7 miles long and 1 mile wide, is located in the bottom of the southern end of the Mariana Trench near the Mariana Islands, which includes the island of Guam. Challenger Deep is 6.83 miles deep, compared to Mount Everest, which is 5.49 miles above sea level.



- 53 Identify the names of tectonic plate A and tectonic plate B. [1]
- 54 Identify the type of tectonic plate boundary shown in the cross section. [1]
- 55 Identify *one* other geologic surface feature, other than a trench, found at the region represented in the cross section. [1]
- 56 The diagram *in your answer booklet* represents the depth of Challenger Deep. For comparison, on the Height of Mount Everest scale to the right, draw a horizontal line across the scale to indicate the height above sea level of Mount Everest. [1]

Base your answers to questions 57 through 59 on the diagram and photograph below and on your knowledge of Earth science. The diagram represents the constellation Ursa Major. One star, *Phecda*, has been labeled. Letter X represents the location of the Messier 81 galaxy (M81), which can be observed near Ursa Major. The photograph shows the Messier 81 galaxy as viewed through a telescope.

Ursa Major



Messier 81 Galaxy



57 *Phecda* has a surface temperature of approximately 9500 K and a luminosity of 63. Identify the name of the star found on the Characteristics of Stars chart in the 2011 Edition Reference Tables for Physical Setting/Earth Science that has a surface temperature and luminosity closest to *Phecda*. [1]

58 State the name of the nuclear process occurring in *Phecda* that produces this star's energy by combining lighter elements into heavier elements. [1]

59 The study of spectral lines from the Messier 81 galaxy suggests that it is moving toward Earth. Identify the color toward which these spectral lines shift when visible light from the Messier 81 galaxy is observed on Earth. [1]

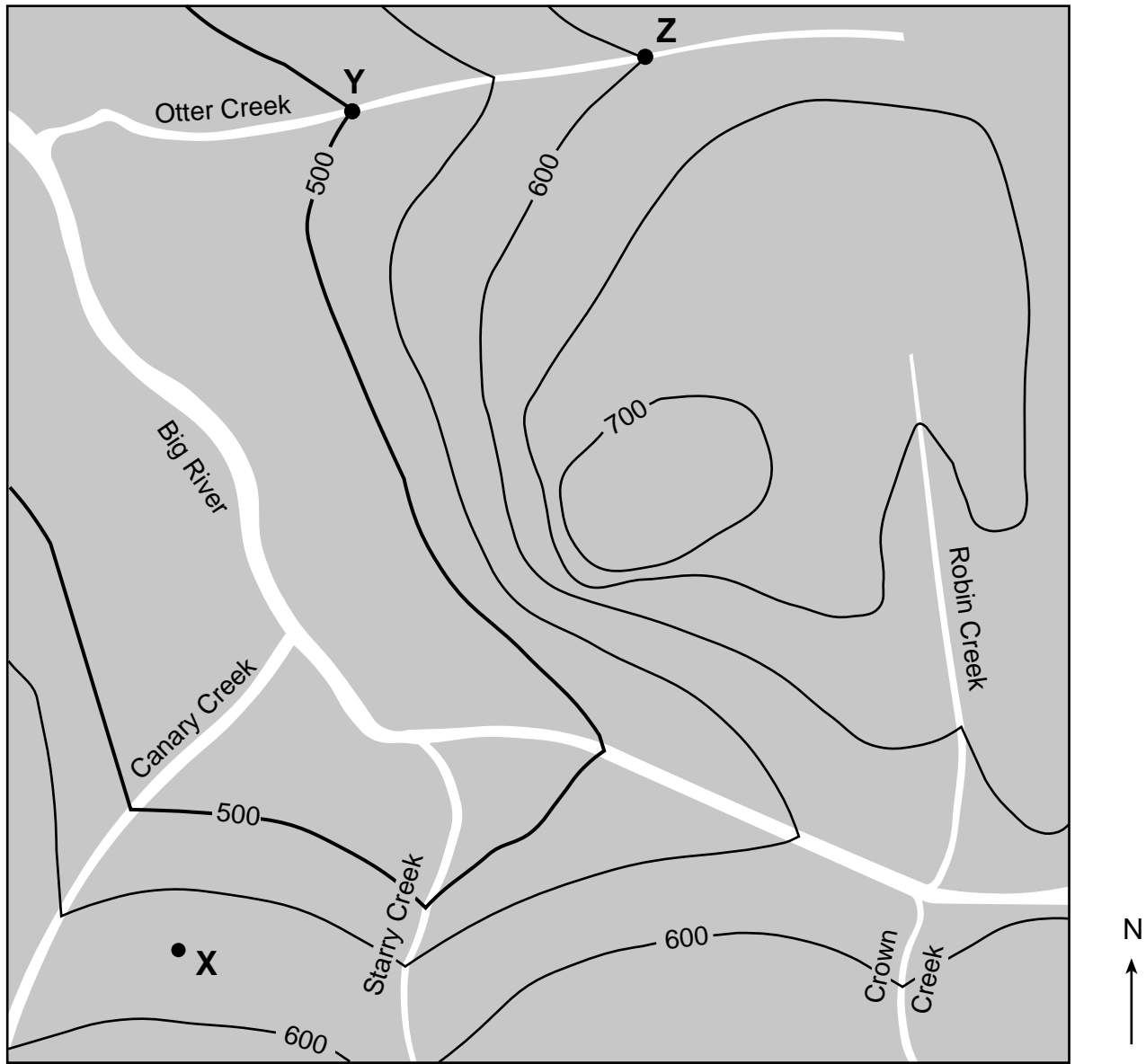
Base your answers to questions 60 through 62 on the diagram in your answer booklet and on your knowledge of Earth science. The diagram represents a model of the radioactive decay of carbon-14. The white boxes represent radioactive carbon-14 remaining, and the black boxes represent the disintegration product after the first half-life.

60 On the diagram *in your answer booklet*, shade in the correct number of carbon-14 boxes to represent the additional disintegration product after the second half-life. [1]

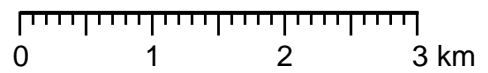
61 State the name of the disintegration product of carbon-14. [1]

62 Explain why carbon-14 would *not* be used to find the age of a *Coelophysis* fossil. [1]

Base your answers to questions 63 through 65 on the topographic map below and on your knowledge of Earth science. Points X, Y, and Z indicate surface locations. Elevations are shown in meters.



Contour interval = 50 meters



63 State *one* possible elevation of point X. [1]

64 Calculate the gradient of Otter Creek, in meters per kilometer, between points Y and Z. [1]

65 Identify the compass direction toward which Canary Creek is flowing. [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 70 on the air pressure field map in your answer booklet and on your knowledge of Earth science. The map shows air pressures recorded in millibars (mb) at locations in eastern North America. Four isobars are shown. Points W, X, Y, and Z represent locations on Earth's surface. Letter L represents the center of a low-pressure system.

- 66 On the map *in your answer booklet*, draw the 1000 mb and 996 mb isobars. [1]
- 67 Which location on the map, W, X, Y, or Z, most likely has the greatest wind speed? Describe *one* piece of evidence on the map indicating that this location has the greatest wind speed. [1]
- 68 Identify the weather instrument used to measure air pressure. [1]
- 69 Describe the *two* characteristics of the general surface wind circulation pattern associated with this low-pressure system. [1]
- 70 One air mass associated with this pressure system originally formed over the Gulf of Mexico. Write the two-letter weather map symbol for this type of air mass. [1]
-

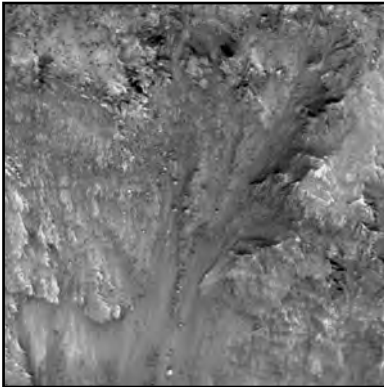
Base your answers to questions 71 through 74 on the passage and photographs below and on your knowledge of Earth science. The photographs show “dark streaks” of water that form and become longer over the summer months on Mars.

Water on Mars

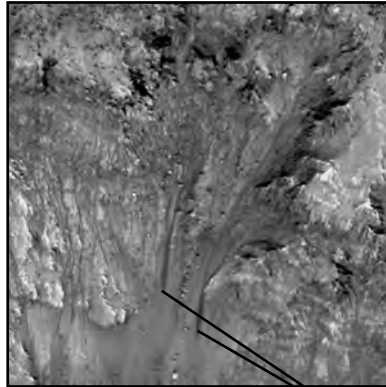
NASA scientists have found evidence of flowing water on Mars. Mysterious “dark streaks” have been viewed forming on the slopes of Martian craters and mountain valleys during the summer months on Mars. These streaks were first thought to be landslides. Additional study caused scientists to infer that these streaks are salt compounds with water chemically attached to them. This salty-water compound is inferred to rise up from underground storage areas after thawing in the summer, or is formed when salts on the surface of Mars absorb water from the atmosphere until there is enough liquid water to run downhill. These salty-water flows are promising sites to find life on Mars. Future human missions to Mars may obtain and process water from this natural source.

Flowing Water On Mars

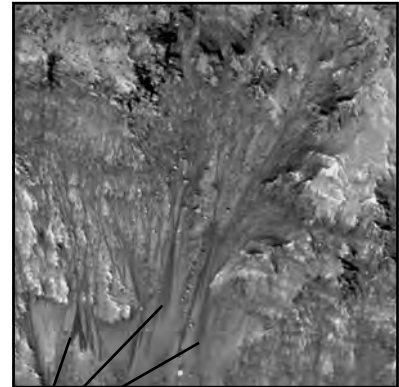
Before Martian Summer:
No “dark streaks”
are visible.



Early Martian Summer:
“Dark streaks”
first become visible.



Late Martian Summer:
“Dark streaks” become longer
and more numerous.



Dark Streaks

71 Identify the force that causes the type of mass movement first inferred to have formed the “dark streaks.” [1]

72 Identify *one* event that could have formed the Martian craters. [1]

73 Determine the number of days from the first day of summer on Mars to the next first day of summer on Mars. [1]

74 Indicate whether Mars is classified as a terrestrial planet or Jovian planet by circling the correct term *in your answer booklet*. Explain why Mars is classified as this type of planet. [1]

Base your answers to questions 75 through 79 on the data table below and on your knowledge of Earth science. The data table shows how the destruction of the ozone layer in Earth's atmosphere has affected the amount of ultraviolet radiation reaching Earth's surface beneath the areas of ozone destruction.

Ozone Loss and Ultraviolet Radiation

Ozone Destruction (%)	Average Increase in Ultraviolet Radiation Reaching Earth's Surface (%)
0	0
5	5
10	12
15	20
20	28
25	36
30	47
35	60
40	76

- 75 On the grid *in your answer booklet*, construct a line graph by plotting the data for the average increase in ultraviolet radiation reaching Earth's surface for each percentage of ozone destruction shown on the data table. Connect *all nine* plots with a line. [1]
- 76 Ozone destruction was estimated to be 22% in the atmosphere above a Lake Ontario beach. Based on the pattern shown in the data table, predict the average increase in ultraviolet radiation reaching that beach. [1]
- 77 The ozone layer is mostly concentrated between 20 and 25 kilometers above Earth's surface. State the name of the atmospheric temperature zone layer where this ozone concentration can be found. [1]
- 78 On the table *in your answer booklet*, place one check mark in each row to compare the relative wavelengths of other types of electromagnetic radiation to ultraviolet (UV) radiation. [1]
- 79 Ozone closer to Earth's surface has been identified as a greenhouse gas. Identify *two* other gases in Earth's atmosphere that are considered major greenhouse gases. [1]
-

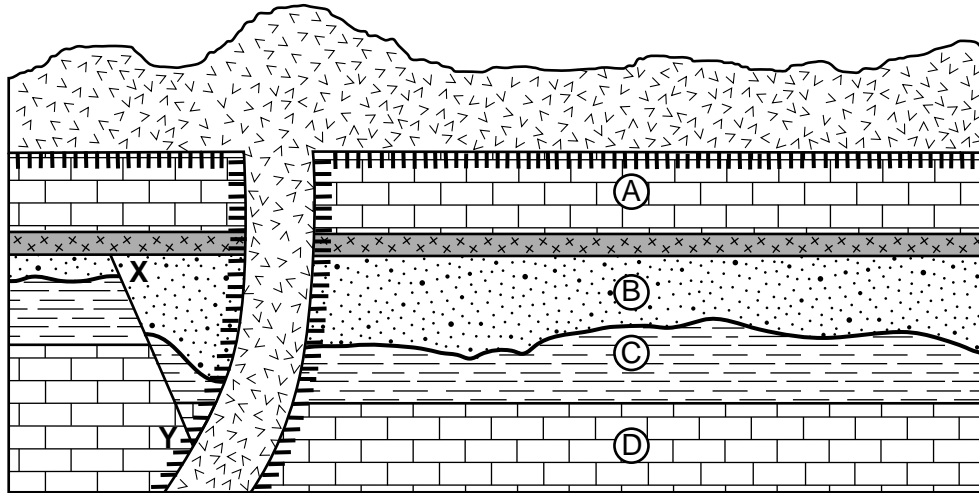
Base your answers to questions 80 through 82 on the diagram in your answer booklet and on your knowledge of Earth science. The diagram represents the apparent paths of the Sun observed in solar time (time based on the Sun's position in the sky) at Albany, New York, on June 21 and December 21. A portion of the Sun's path on June 21 is shaded. A protractor has been included in the diagram.

80 On the diagram *in your answer booklet*, draw an **X** to indicate the position of sunrise on March 21. [1]

81 Determine the altitude of the Sun at solar noon on December 21 and June 21. [1]

82 The shaded portion on the June 21 path represents 45 degrees of the Sun's apparent motion. Determine the number of hours that this shaded portion represents. [1]

Base your answers to questions 83 through 85 on the geologic cross section below and on your knowledge of Earth science. The cross section represents sedimentary rock units labeled A through D, a layer of volcanic ash deposits, and a basalt extrusion. An unconformity is present between rock units B and C. Line XY represents a fault. The rock layers have *not* been overturned.



Key	
	Basalt
	Volcanic ash
	Contact metamorphism

- 83 State the name of *one* metamorphic rock that most likely formed in the zone of contact metamorphism between rock unit A and the basalt. [1]
- 84 Fossils of the first multicellular, soft-bodied marine organisms were found in rock unit D. Identify the eon that indicates the geologic age of this rock unit. [1]
- 85 Determine the relative age sequence of the following geologic features, in order from oldest to youngest: [1]

- Basalt
 - Fault XY
 - Volcanic ash
-

PHYSICAL SETTING EARTH SCIENCE

Friday, January 25, 2019 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

Student

Teacher

School Grade

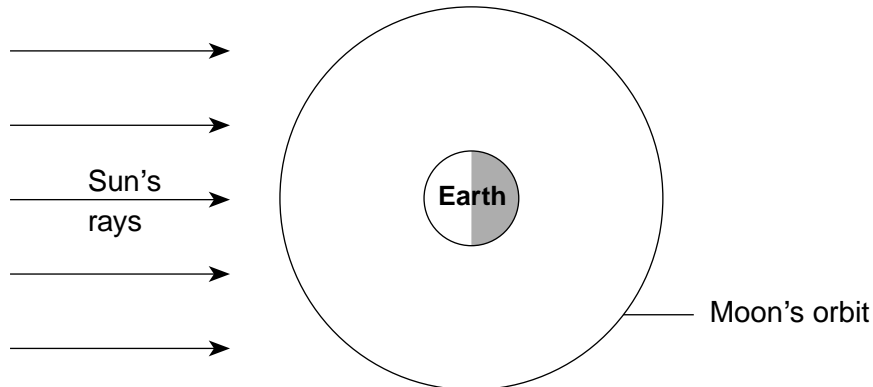
Record your answers for Part B–2 and Part C in this booklet.

Part B–2

51

New York State Location	Total Solar Eclipse Visible
Kingston	
Massena	
Niagara Falls	
Riverhead	
Oswego	

52



(Not drawn to scale)

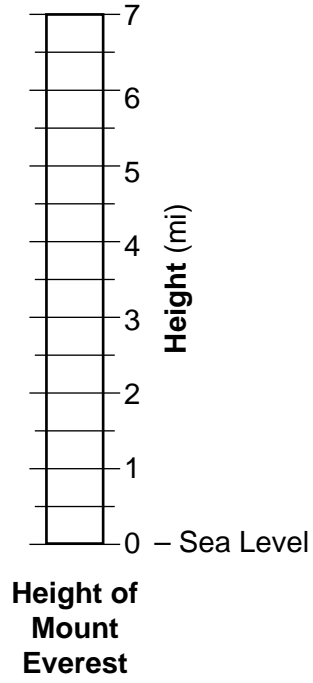
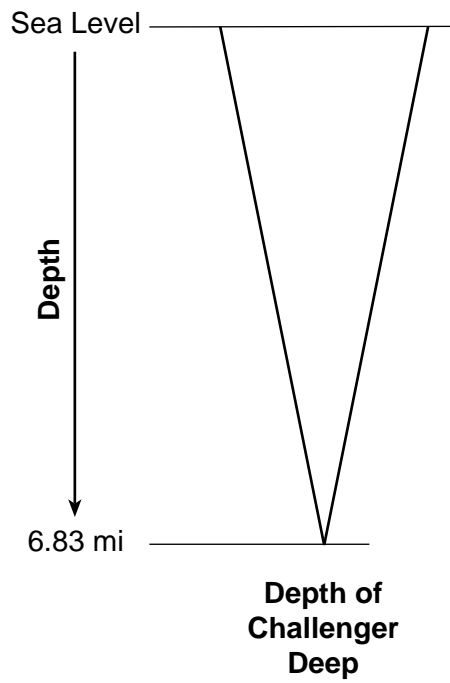
53 Plate A: _____ Plate

Plate B: _____ Plate

54 _____

55 _____

56



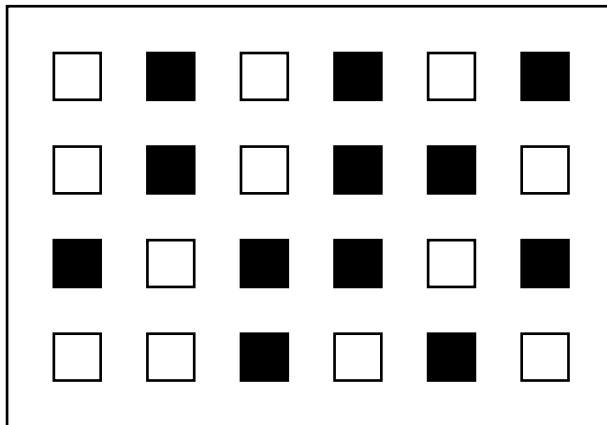
57 _____

58 _____

59 _____

60

Model of Carbon -14 Radioactive Decay



Key	
□	Radioactive carbon-14
■	Disintegration product

61 _____

62 _____

63 _____ m

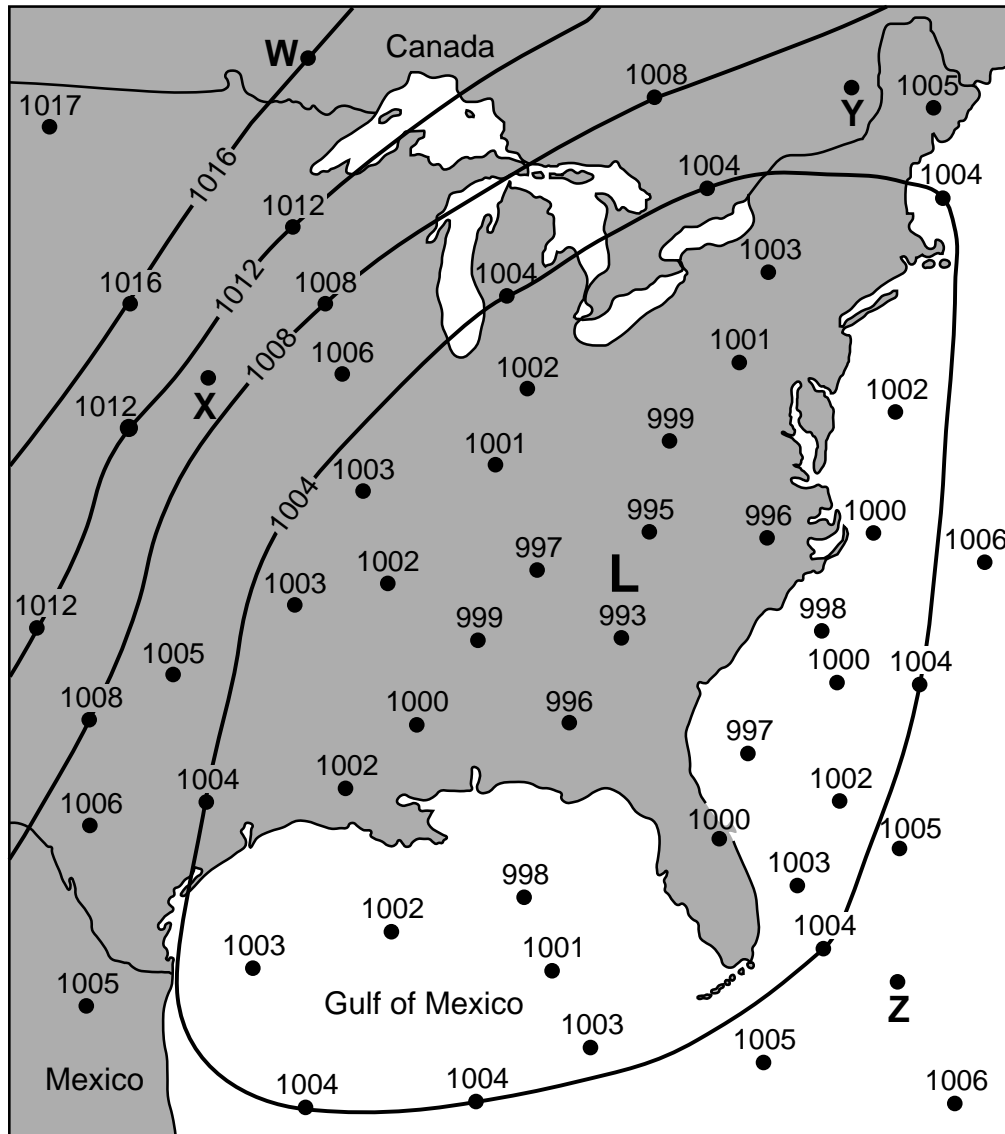
64 _____ m/km

65 _____

Part C

66

Air Pressure Field Map



67 Location: _____

Evidence: _____

68 _____

69 Characteristic 1: _____

Characteristic 2: _____

70 _____

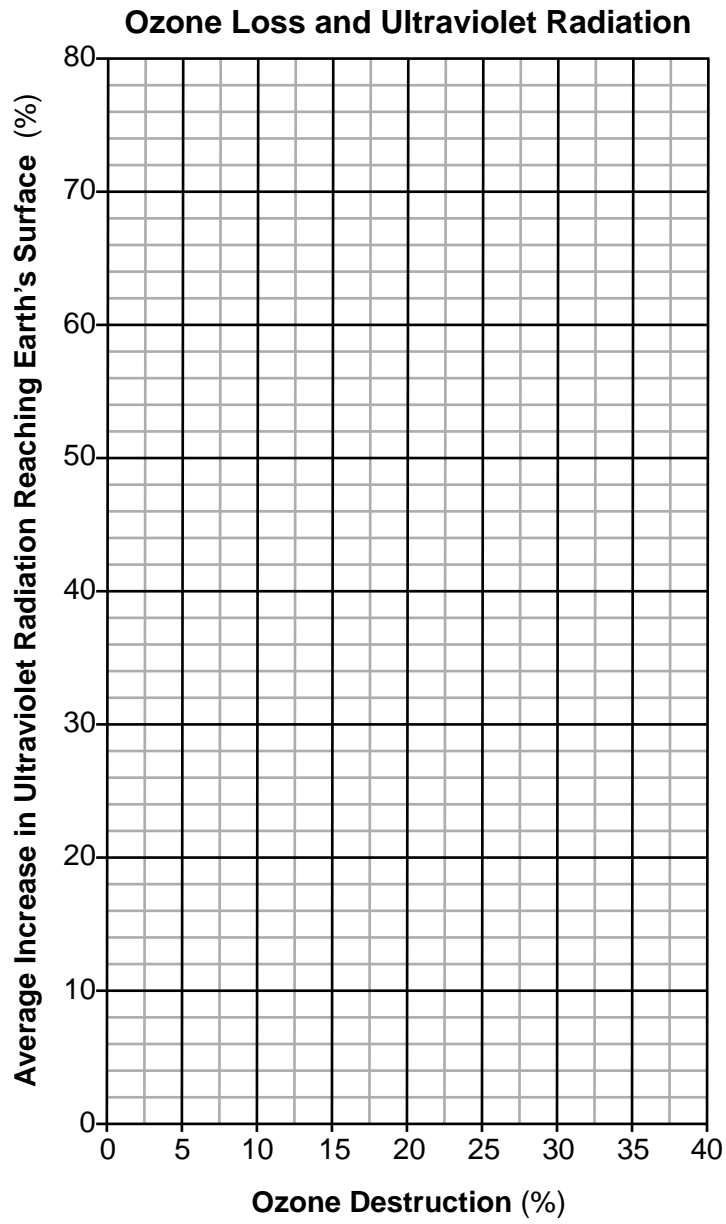
71 _____

72 _____

73 _____ d

74 Circle one: **Terrestrial Planet** **Jovian Planet**

Explanation: _____



76 _____ %

77 _____

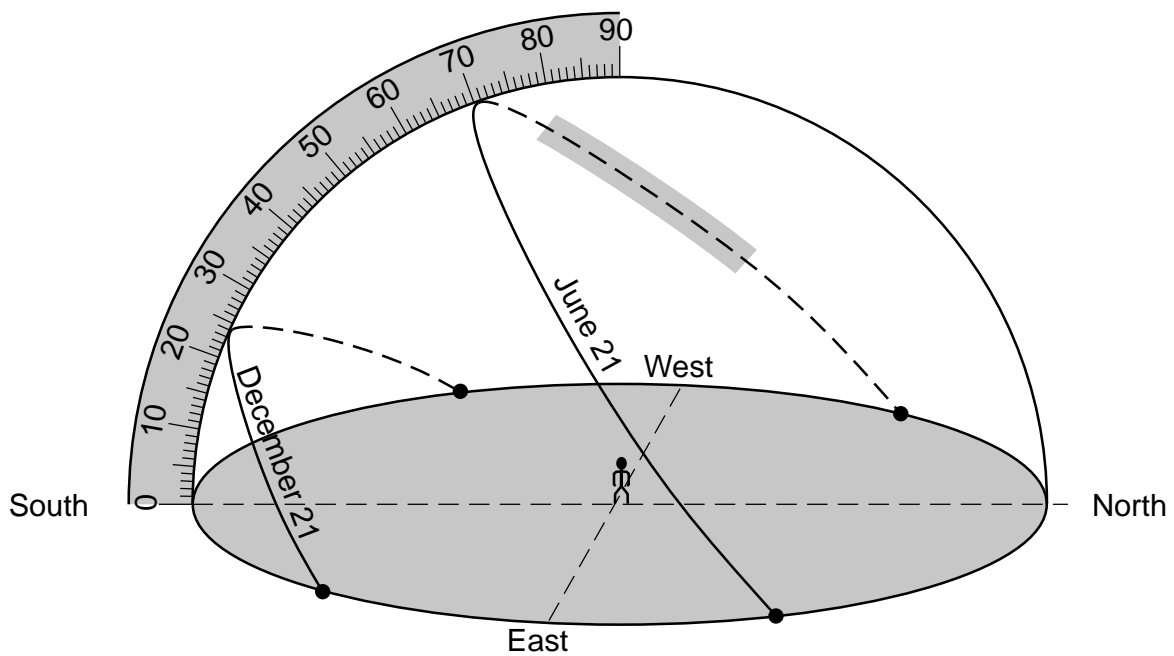
78

Wavelength Comparison to Ultraviolet (UV) Radiation

Type of Electromagnetic Radiation	All Wavelengths Shorter Than UV	All Wavelengths Longer Than UV	Some Wavelengths Shorter and Some Wavelengths the Same as UV
Gamma Rays			
Microwaves			
Visible light			
X rays			

79 _____ and _____

80

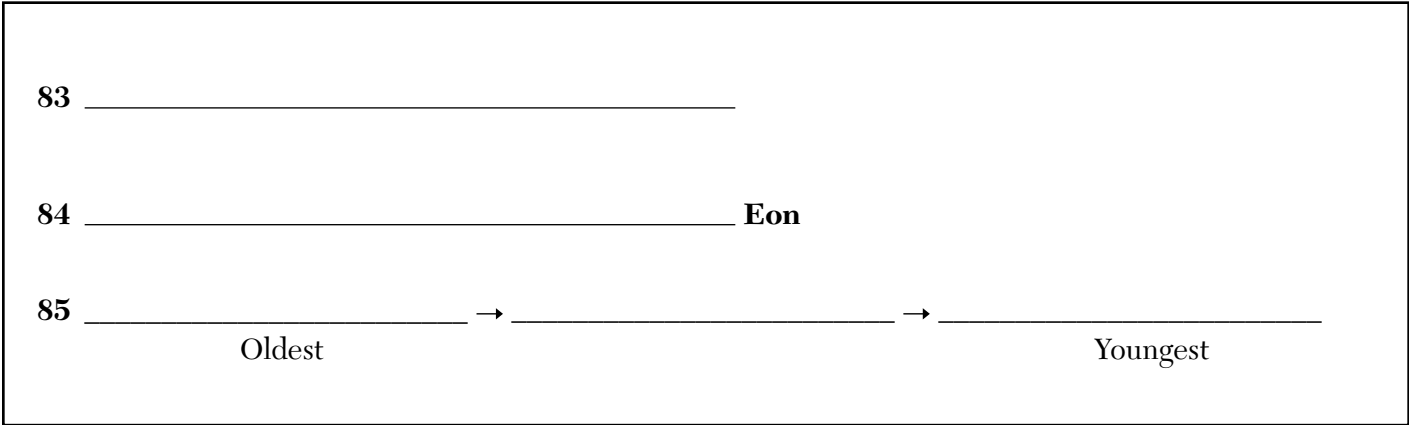


81 December 21: _____ °

June 21: _____ °

82 _____ h

P.S./EARTH SCIENCE



FOR TEACHERS ONLY

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

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

Friday, January 25, 2019 — 9:15 a.m. to 12:15 p.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 4	10 1	19 3	28 2
2 4	11 3	20 1	29 2
3 1	12 3	21 4	30 2
4 2	13 2	22 3	31 1
5 4	14 1	23 4	32 4
6 2	15 4	24 4	33 2
7 3	16 4	25 3	34 1
8 2	17 3	26 2	35 2
9 4	18 1	27 1	

Part B–1

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

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 Friday, January 25, 2019. 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 if *only* the *three* boxes are checked as shown below.

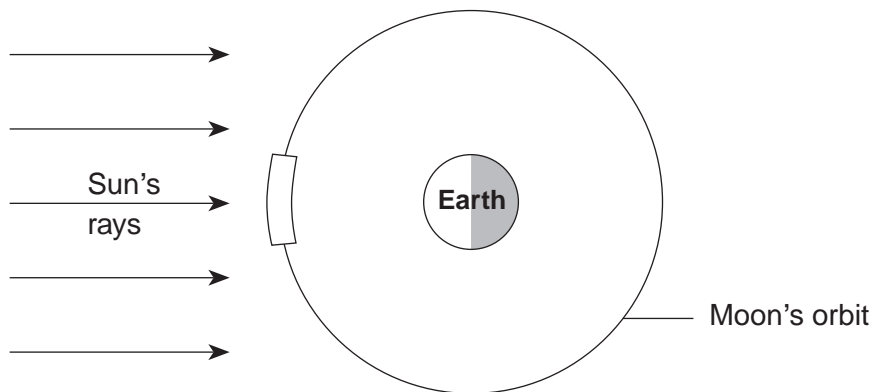
Note: Allow credit if a symbol other than a check mark is used.

New York State Location	Total Solar Eclipse Visible
Kingston	
Massena	✓
Niagara Falls	✓
Riverhead	
Oswego	✓

52 [1] Allow 1 credit if the center of the **X** is within or touches the clear band 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.



(Not drawn to scale)

53 [1] Allow 1 credit for identifying *both* Plate A as the Philippine Plate and Plate B as the Pacific Plate.

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

- convergent boundary
- convergence
- subduction
- plate collision

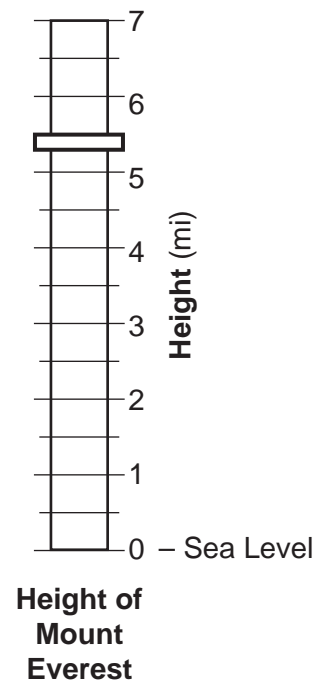
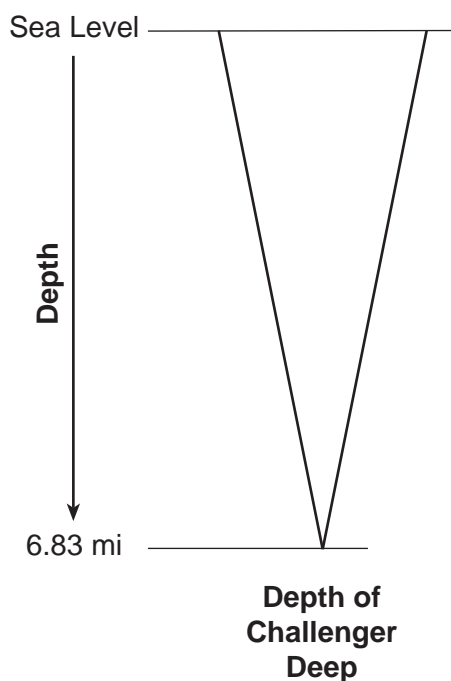
55 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- volcanoes/volcanic islands
- island arc/Mariana Island Group
- island of Guam/islands
- mountains
- seamounts
- faults

56 [1] Allow 1 credit if the student-drawn line is within or touches the rectangle shown.

Note: Do *not* allow credit if the student line is *only* on the “Depth of Challenger Deep” graph, because that is depth below sea level.

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



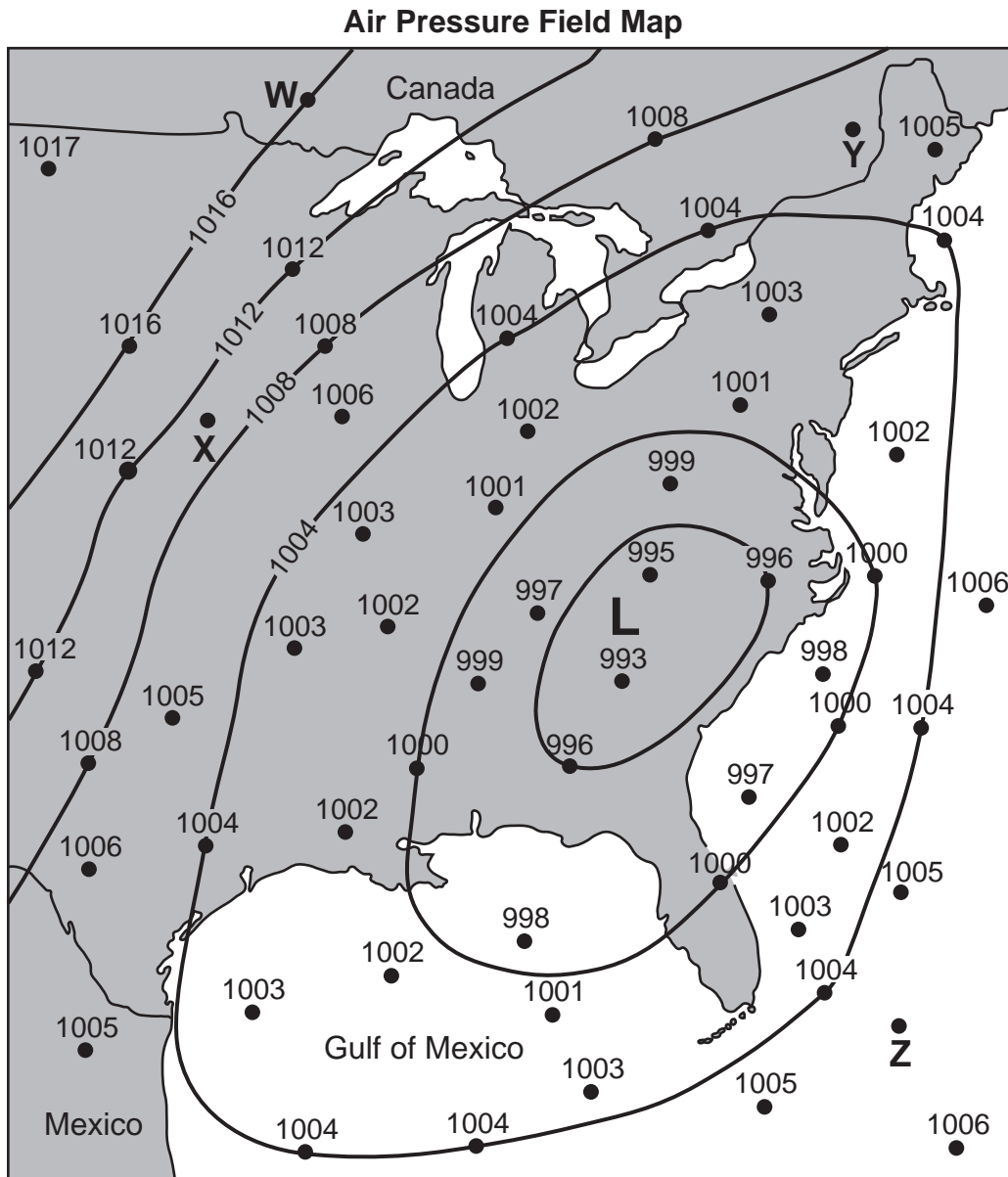
- 57 [1] Allow 1 credit for *Sirius*.
- 58 [1] Allow 1 credit for fusion *or* nuclear fusion.
- 59 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- blue
 - blue shift
 - violet
- 60 [1] Allow 1 credit for shading in *any* six additional carbon-14 boxes (leaving only six boxes unshaded).
- 61 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- ^{14}N
 - nitrogen-14
 - N-14
- 62 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- The percent of ^{14}C would be undetectable in a 200-million-year-old *Coelophysis*.
 - Carbon-14 has too short a half-life.
 - Not enough carbon-14 remains in fossils more than 50,000 years old.
 - The fossil is too old to use ^{14}C .
 - Carbon-14 dating can only be used on organic specimens of recent age.
 - Too little of the radioactive sample would remain.
- Note:** Do *not* allow credit for the age of the *Coelophysis* fossil alone because this does not give a reason as to why C-14 cannot be used on a fossil of this age.
- 63 [1] Allow 1 credit for any value greater than 550 m, but less than 600 m.
- 64 [1] Allow 1 credit for any value from 38 m/km to 42 m/km.
- 65 [1] Allow 1 credit for northeast/NE *or* north northeast/NNE.

Part C

Allow a maximum of 20 credits for this part.

- 66 [1] Allow 1 credit if *both* the 1000 mb and 996 mb isobars are correctly drawn. The isobars must pass through or touch *both* 996 dots and *all four* 1000 dots. If additional isobars are drawn, *all* isobars must be correct to receive credit.

Example of a 1-credit response:



67 [1] Allow 1 credit for *both* letter *X* and acceptable evidence. Acceptable evidence includes, but is not limited to:

Evidence:

- The isobars are close/closest together at location *X*.
- Air pressure changes more over a shorter distance.
- The isolines/lines are closest.
- The air pressure gradient is greatest at *X*.

68 [1] Allow 1 credit for barometer *or* barograph.

69 [1] Allow 1 credit for *two* correct characteristics. The order of the characteristics may vary. Acceptable responses include, but are not limited to:

Characteristic 1:

- Winds blow inward/in.
- toward the center
- from higher to lower pressure
- Surface winds converge.

Characteristic 2:

- counterclockwise
- Winds are cyclonic.

70 [1] Allow 1 credit for mT. Allow credit for either uppercase or lowercase letters.

Note: Do *not* allow credit if air-mass letters are reversed, such as Tm or TM.

For students who used the Spanish edition, either exclusively or in conjunction with the English edition of the exam, allow credit for the correct two-letter air-mass symbol as it appears in either the English or Spanish *2011 Edition Reference Tables for Physical Setting/Earth Science*.

71 [1] Allow 1 credit for gravity *or* gravitation.

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

- volcanic eruption
- asteroid impact
- hit by a meteor
- impact event

Note: Do *not* allow credit for “comet,” “asteroid,” *or* “meteor” alone because these are objects, *not* events.

73 [1] Allow 1 credit for 687 d.

74 [1] Allow 1 credit for *both* circling terrestrial planet and providing an acceptable explanation. Acceptable explanations include, but are not limited to:

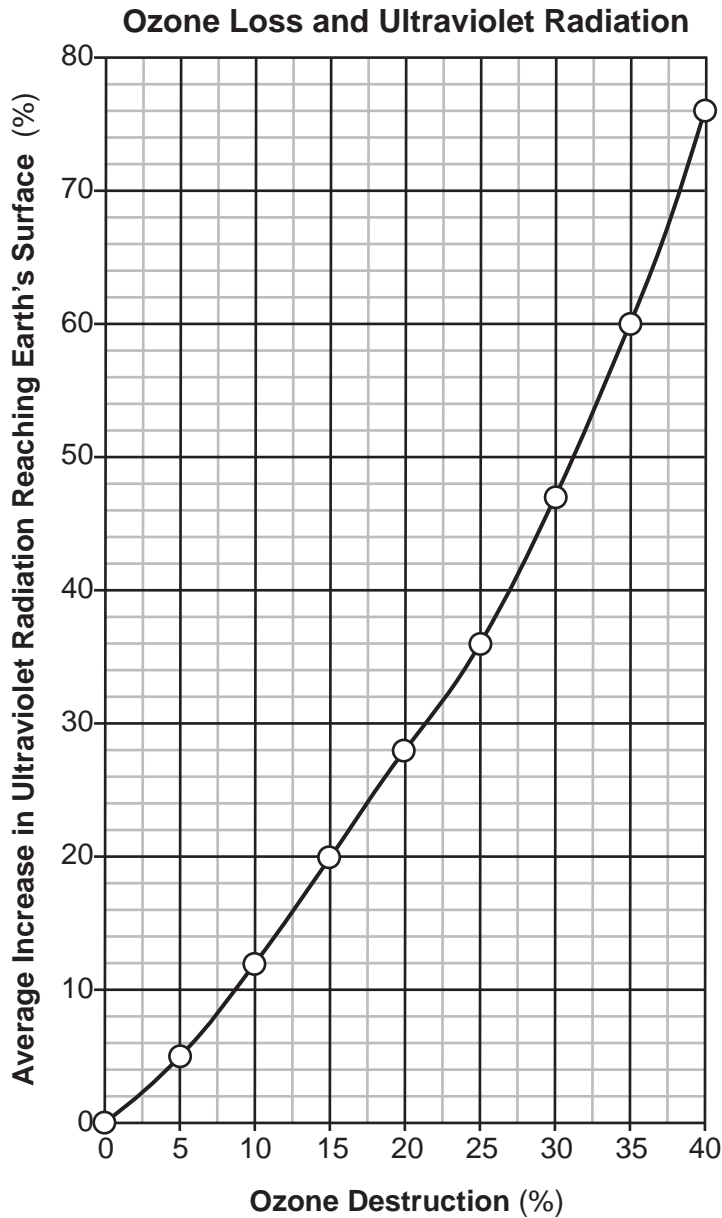
- Mars is a small rocky planet.
- The density of the planet Mars is large/has a high density.
- Mars is *not* made of mostly gases and liquids.
- Jovian planets are less dense and larger than terrestrial planets.

Note: Do *not* allow credit for “Mars is closer to the Sun” or “Mars is an inner planet” because these only indicate locations of terrestrial planets in our solar system.

75 [1] Allow 1 credit if the centers of *all nine* 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 plots, but is still within or touching the circles.

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



76 [1] Allow 1 credit for any value from 29% to 33%.

77 [1] Allow 1 credit for stratosphere.

78 [1] Allow 1 credit for a correctly completed chart as shown below.

Note: Allow credit if a symbol other than a check mark is used.

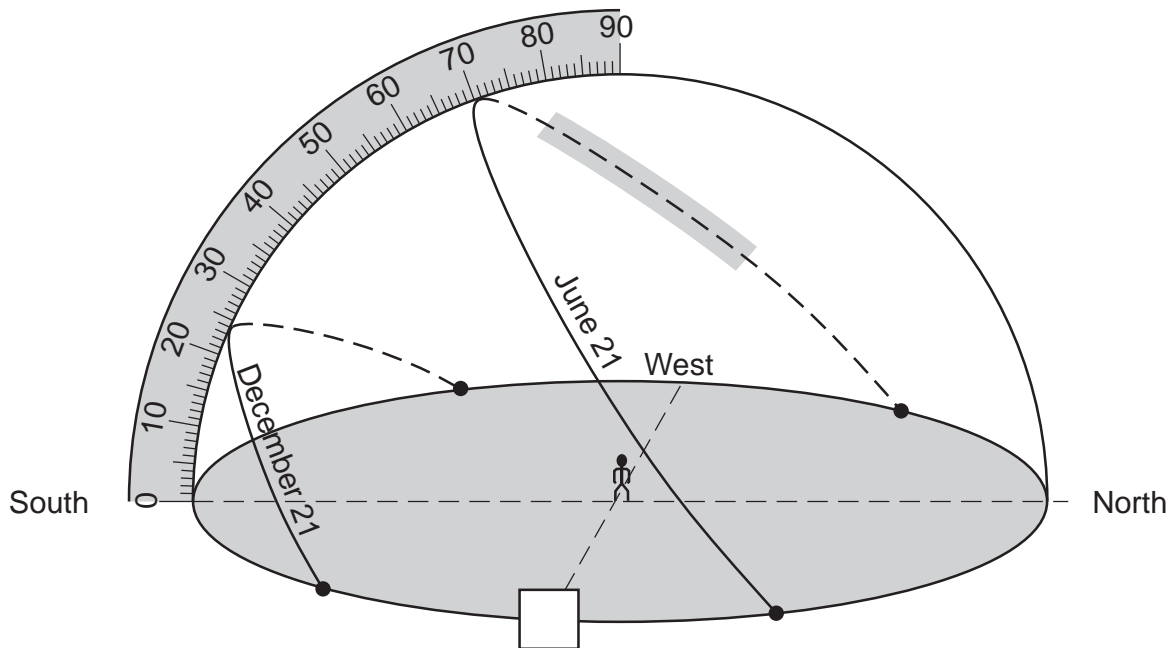
Wavelength Comparison to Ultraviolet (UV) Radiation

Type of Electromagnetic Radiation	All Wavelengths Shorter Than UV	All Wavelengths Longer Than UV	Some Wavelengths Shorter and Some Wavelengths the Same as UV
Gamma Rays	✓		
Microwaves		✓	
Visible light		✓	
X rays			✓

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

- carbon dioxide/CO₂
- water vapor/H₂O
- methane/CH₄
- nitrous oxide/N₂O
- chlorofluorocarbons/CFC

80 [1] Allow 1 credit if the center of the **X** is within or touches the clear box shown below.



Note: Allow credit if a symbol other than an **X** is used. If a student correctly draws a line to represent the March 21 Sun's path, the sunrise position must still be indicated.

81 [1] Allow 1 credit for *two* correct responses.

December 21: Any value from 23° to 24°

June 21: Any value from 70° to 71°

Note: Do *not* allow credit if a compass direction is included (23.5° S or 70° N) with any number because this denotes a latitude, not an altitude.

82 [1] Allow 1 credit for 3 h *or* three hours.

83 [1] Allow 1 credit for marble *or* hornfels.

84 [1] Allow 1 credit for Precambrian Eon *or* Proterozoic Eon.

Note: Do *not* allow credit for “Late Proterozoic” or “Late Precambrian” because these are eras, not eons.

85 [1] Allow 1 credit for the correct sequence as shown below.

$$\frac{\text{Fault XY or Fault or XY}}{\text{Oldest}} \rightarrow \frac{\text{Volcanic Ash or Ash}}{\text{}} \rightarrow \frac{\text{Basalt}}{\text{Youngest}}$$

Regents Examination in Physical Setting/Earth Science

January 2019

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

The Chart for Determining the Final Examination Score for the January 2019 Regents Examination in Physical Setting/Earth Science will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Friday, January 25, 2019. 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

January 2019 Physical Setting/Earth Science			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	14	37, 56, 60, 64	73, 75
Math Key Idea 2	8, 9, 11, 18, 22, 33	38, 57, 63	66, 76, 77, 78, 81
Math Key Idea 3	30		
Science Inquiry Key Idea 1	2, 7, 12, 13, 19, 31, 32	36, 38, 39, 42, 48, 55, 58, 59, 60, 61	70, 71, 72, 74, 79
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3	3, 5, 11, 15, 16, 17, 22, 24, 25, 26, 27, 28, 29, 30	37, 40, 41, 42, 43, 45, 50, 51, 53, 54, 57, 61, 62, 64	70, 73, 74, 77, 78, 83, 84
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			76
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1	10, 20, 21, 23, 35	44, 46, 47, 52, 59, 65	67, 68, 80
Key Idea 2	5, 6, 8, 15, 16, 18, 19, 21, 27, 28, 29, 31, 32, 34, 35	39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 60, 63, 65	66, 67, 69, 80, 81, 83, 84, 85
Key Idea 3	1, 14, 30	42, 56	78, 85
Key Idea 4	1		
Key Idea 5	4, 6, 9, 12, 33, 34	49	69, 76
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, 10, 14, 16, 17, 30, 31, 33	36, 37, 38, 39, 40, 41, 51, 52, 57, 58, 60, 61, 62	73, 74, 80, 84, 85
Key Idea 2	11, 12, 13, 15, 18, 19, 20, 21, 22, 23, 32, 34, 35	40, 42, 43, 44, 45, 46, 47, 48, 49, 50, 53, 54, 55, 56, 63, 64, 65	66, 67, 68, 69, 70, 71, 72, 75, 76, 77, 78, 79
Key Idea 3	24, 25, 26, 27, 28, 29		83
Reference Tables			
ESRT 2011 Edition (Revised)	3, 5, 11, 15, 16, 17, 18, 22, 24, 25, 26, 27, 28, 29, 30	37, 40, 41, 42, 43, 45, 50, 51, 53, 54, 57, 61, 62, 64	70, 73, 74, 77, 78, 83, 84

The State Education Department / The University of the State of New York
Regents Examination in Physical Setting/Earth Science – January 2019
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 65 would receive a final examination score of 85.

		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	92	92	92	91	91	90	90	89	88	87	86	85	84	82	81	79	77
	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	90	90	89	89	88	88	87	86	85	85	84	82	81	80	78	77	75
	67	89	89	88	88	87	87	86	85	85	84	83	82	80	79	77	76	74
	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	85	85	84	84	83	83	82	81	80	79	78	77	76	74	72	71	
61	85	84	84	84	83	82	82	81	80	79	78	77	76	75	73	72	70	
60	84	84	83	83	82	82	81	80	80	79	78	77	75	74	72	71	69	
59	83	83	82	82	81	81	80	79	79	78	77	76	74	73	71	70	68	
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	72	72	71	71	70	70	69	68	68	67	66	65	63	62	60	59	57	
45	71	71	70	70	69	69	68	68	67	66	65	64	63	61	60	58	56	

**Final Examination Scores
 Regents Examination in Physical Setting/Earth Science – January 2019 – 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	58	58	57	57	56	56	55	54	53	52	51	50	48	47	45	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	55	55	54	54	53	53	52	51	51	50	49	48	46	45	43	42	40
	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	46	46	45	45	44	44	43	42	41	40	39	38	37	35	33	31
	21	45	44	44	44	43	43	42	41	40	40	38	37	36	35	33	32	30
	20	44	44	43	43	42	42	41	40	40	39	38	37	35	34	32	31	29
	19	42	42	41	41	41	40	39	39	38	37	36	35	34	32	31	29	27
	18	41	40	40	39	39	38	38	37	36	35	34	33	32	31	29	27	26
	17	40	39	39	38	38	37	37	36	35	34	33	32	31	30	28	26	25
	16	38	38	37	37	36	36	35	34	34	33	32	31	29	28	26	25	23
	15	37	37	36	36	35	35	34	34	33	32	31	30	29	27	26	24	22
	14	35	35	35	34	34	33	33	32	31	30	29	28	27	26	24	22	20
	13	35	34	34	33	33	32	32	31	30	29	28	27	26	25	23	21	20
	12	33	33	32	32	31	31	30	29	29	28	27	26	24	23	21	20	18
	11	31	31	30	30	30	29	28	28	27	26	25	24	23	21	20	18	16
	10	30	30	30	29	29	28	27	27	26	25	24	23	22	20	19	17	15
	9	29	28	28	27	27	26	26	25	24	23	22	21	20	19	17	15	14
	8	27	27	26	26	25	25	24	23	23	22	21	20	18	17	15	14	12
	7	26	26	25	25	24	24	23	22	22	21	20	19	18	16	15	13	11
	6	24	24	24	23	23	22	22	21	20	19	18	17	16	14	13	11	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	18	18	17	17	16	16	15	14	13	12	11	10	9	7	5	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