

PHYSICAL SETTING EARTH SCIENCE

Thursday, January 25, 2018 — 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.

1 The deflection of Earth's planetary winds is an example of

- (1) the Coriolis effect
- (2) the Doppler effect
- (3) convection
- (4) gravitational pull

2 The universe is approximately 13.8 billion years old. Compared to the age of the solar system, the age of the universe is approximately

- (1) the same age as the solar system
- (2) two times older than the solar system
- (3) three times older than the solar system
- (4) four times older than the solar system

3 Planets that are closest to the Sun are identified as

- (1) low-density Jovian
- (2) low-density terrestrial
- (3) high-density Jovian
- (4) high-density terrestrial

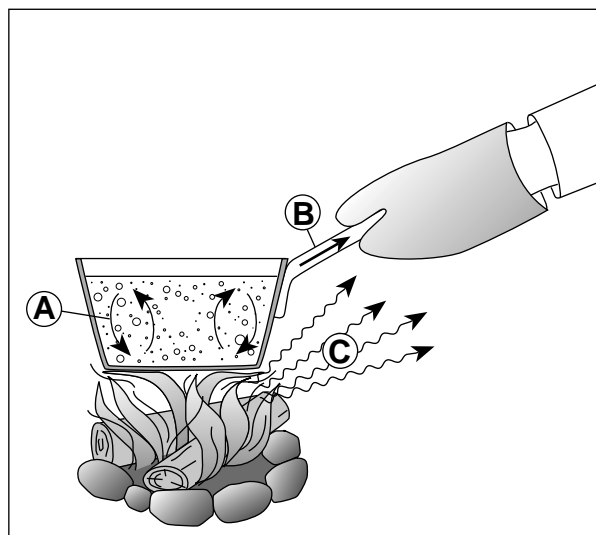
4 Which process of the water cycle occurs when water absorbs 2260 Joules of heat energy per gram?

- (1) melting of ice
- (2) condensation of water vapor
- (3) evaporation of water
- (4) freezing of water

5 In which temperature zone of Earth's atmosphere is the polar jet stream located?

- (1) lower thermosphere
- (2) lower mesosphere
- (3) upper stratosphere
- (4) upper troposphere

6 Arrows in the diagram below show three methods of energy transfer labeled A, B, and C.



Which list correctly identifies the energy transfer processes A, B, and C?

- | | |
|------------------|------------------|
| (1) A—conduction | (3) A—convection |
| B—convection | B—radiation |
| C—radiation | C—conduction |
| (2) A—convection | (4) A—conduction |
| B—conduction | B—radiation |
| C—radiation | C—convection |

7 What is the relative humidity of the air when the dry-bulb temperature is 4°C and the dewpoint is -4°C ?

- | | |
|---------|---------|
| (1) 42% | (3) 51% |
| (2) 46% | (4) 56% |

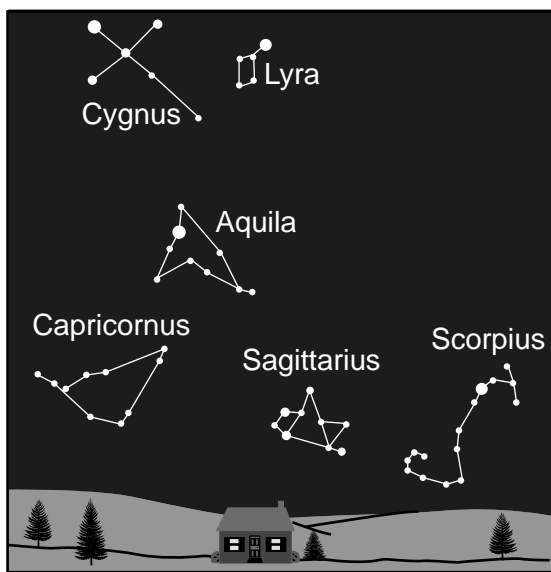
8 The diagram below represents the light spectra given off by the same element as observed under two different conditions. Spectrum A was observed when that element was heated in a laboratory. Spectrum B shows the same element as seen in the light from a distant star.



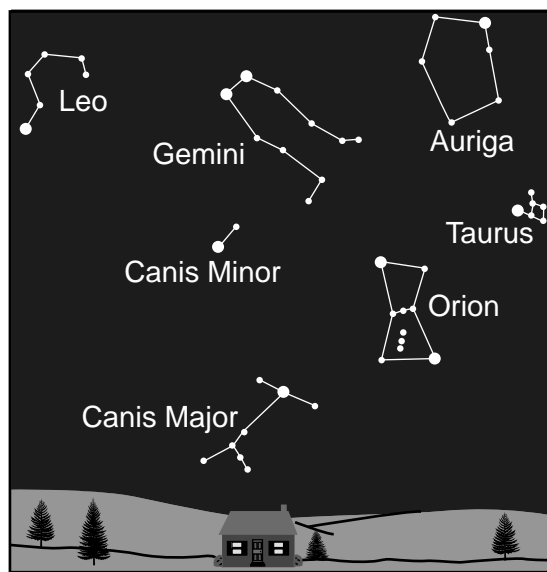
The light spectrum observed from this distant star shows a

- (1) red shift, which indicates that the star is moving away from Earth
- (2) red shift, which indicates that the star is moving toward Earth
- (3) blue shift, which indicates that the star is moving away from Earth
- (4) blue shift, which indicates that the star is moving toward Earth

9 The diagrams below represent the constellations seen by an observer in New York State while looking toward the southern horizon at midnight on July 9 and January 8.



Southern horizon
July 9

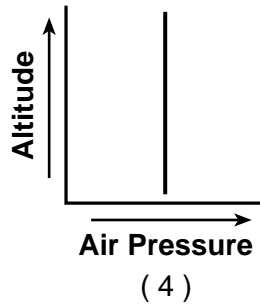
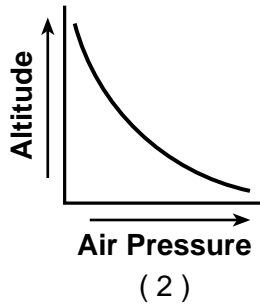
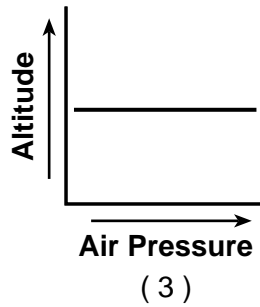
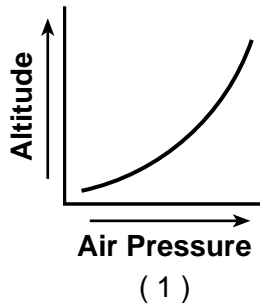


Southern horizon
January 8

Which motion is mainly responsible for the difference in the constellations visible at midnight on these two dates?

- (1) The Sun orbits Earth.
- (2) Earth orbits the Sun.
- (3) The stars in the constellations orbit Earth.
- (4) Earth orbits the stars in the constellations.

10 Which graph best shows the general relationship between air pressure and altitude?



11 Most clouds form in the atmosphere when moist air

- (1) rises, expands, and cools to the dewpoint
- (2) rises, expands, and warms to the dewpoint
- (3) sinks, compresses, and cools to the dewpoint
- (4) sinks, compresses, and warms to the dewpoint

12 Equal areas of which surface would absorb the greatest amount of insolation on a sunny day?

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

13 Which natural event periodically weakens western surface ocean currents in the equatorial Pacific Ocean, resulting in a change in air temperature and precipitation patterns in the United States?

- (1) El Niño
- (2) transpiration
- (3) ocean tides
- (4) volcanic eruptions

14 Ocean gyres in the Northern Hemisphere consist of a number of surface ocean currents that, together, generally flow clockwise in a roughly circular pattern. Which list contains three warm surface ocean currents that make up most of the North Atlantic Ocean gyre?

- (1) Kuroshio Current, North Pacific Current, and California Current
- (2) Canary Current, North Equatorial Current, and Equatorial Countercurrent
- (3) Labrador Current, North Atlantic Current, and East Greenland Current
- (4) North Equatorial Current, Gulf Stream Current, and North Atlantic Current

15 Most of the oceanic oxygen that began to enter Earth's atmosphere in the early Proterozoic Era was probably produced by

- (1) formation of silicate rocks
- (2) photosynthesis by cyanobacteria
- (3) impact events on Earth's surface
- (4) outgassing from volcanoes

16 During which geologic period did plants and animals first appear in land environments?

- (1) Cambrian
- (2) Ordovician
- (3) Silurian
- (4) Devonian

17 Sedimentary rock layers that were deposited between 488 million and 444 million years ago are found on the surface at which two New York State locations?

- (1) Ithaca and Jamestown
- (2) Utica and Syracuse
- (3) Oswego and Old Forge
- (4) Albany and Massena

18 A volcanic ash layer is a good geologic time marker for correlating rock layers because the ash layer was deposited over a

- (1) limited geographic area over a short time
- (2) limited geographic area over a long time
- (3) wide geographic area over a short time
- (4) wide geographic area over a long time

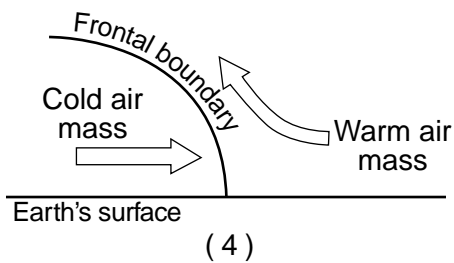
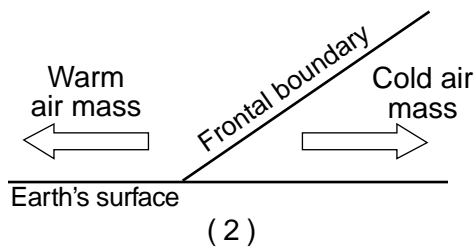
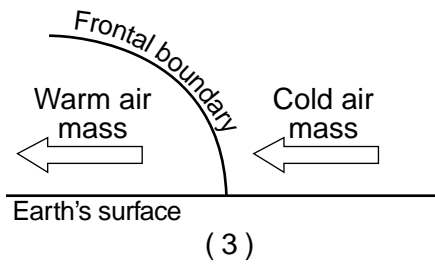
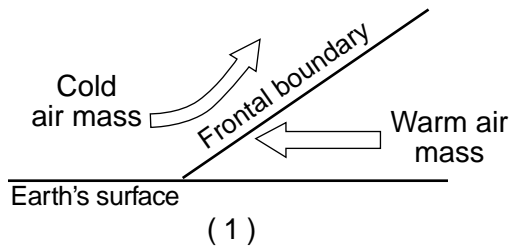
19 The photograph below shows the results of a landslide.



This landslide is an example of

- (1) wind abrasion
- (2) glacial deposition
- (3) wave action
- (4) mass movement

20 Which cross section correctly represents a cold front and the air-mass movements associated with this front?



- 21 Earth's interior at a depth of 3500 kilometers is believed to be
- (1) liquid at a temperature of approximately 4900°C
 - (2) solid at a temperature of approximately 4900°C
 - (3) liquid at a temperature of approximately 5400°C
 - (4) solid at a temperature of approximately 5400°C

- 22 Compared to the density and composition of the oceanic crust, the continental crust is
- (1) less dense and more mafic
 - (2) less dense and more felsic
 - (3) more dense and less mafic
 - (4) more dense and less felsic

- 23 An earthquake occurs at 10:05 a.m. At 10:09 a.m., the first *P*-wave from this earthquake is detected at a seismic station. Approximately how many kilometers (km) from the epicenter is this seismic station located?
- (1) 1000 km
 - (2) 2000 km
 - (3) 2600 km
 - (4) 5600 km

- 24 The aerial photograph below shows two streams that have been displaced by tectonic movement along the San Andreas fault. The arrows show the relative direction of movement along the fault.



This movement occurred along which type of plate boundary?

- (1) convergent
- (2) divergent
- (3) transform
- (4) complex

- 25 The magnitude of an earthquake is a number that represents the
- (1) arrival time of the first *P*-wave
 - (2) difference in arrival times between *P*- and *S*-waves
 - (3) distance to the epicenter
 - (4) energy released by an earthquake

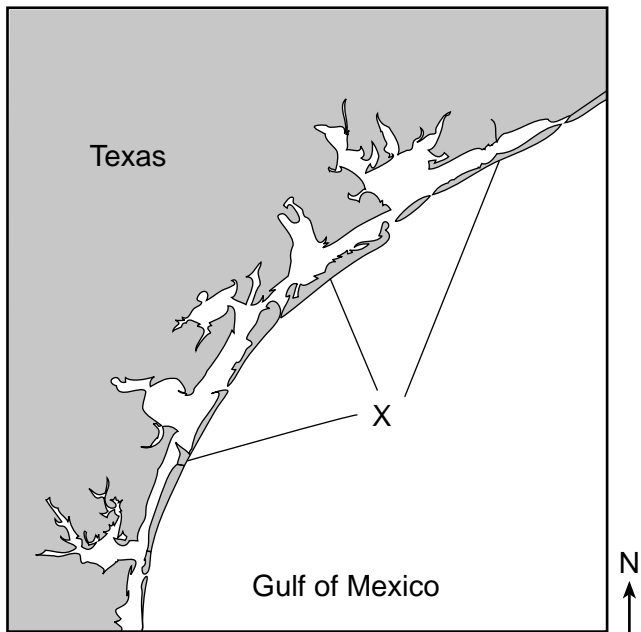
- 26 The Genesee River flows across both the Allegheny Plateau and the Erie-Ontario Lowlands in New York State. This river flows
- (1) northward, in the same general direction as the Hudson River
 - (2) northward, in the same general direction as the Niagara River
 - (3) southward, in the same general direction as the Hudson River
 - (4) southward, in the same general direction as the Niagara River

- 27 What is the name of the largest sediment that can be transported by a stream moving at a velocity of 100 centimeters per second (cm/s)?
- (1) silt
 - (2) sand
 - (3) pebbles
 - (4) cobbles

- 28 Which mineral is commonly used as an abrasive?
- (1) garnet
 - (2) halite
 - (3) sulfur
 - (4) graphite

- 29 If a metamorphic rock bubbles when a drop of acid is placed on its surface, the rock is most likely
- (1) schist
 - (2) slate
 - (3) marble
 - (4) quartzite

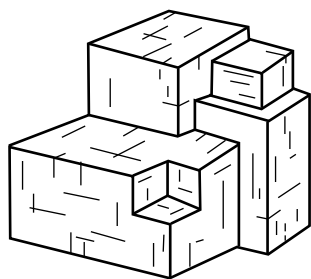
30 The map below shows a portion of the coast of Texas. Letter X indicates features formed by wave action.



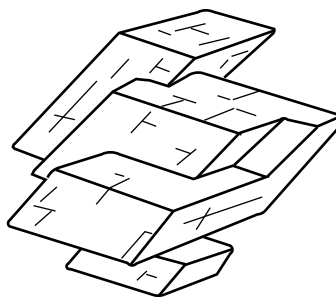
What is the name of the features indicated by letter X?

- (1) barrier islands
- (2) island arc
- (3) deltas
- (4) moraines

31 The diagrams below represent the crystal shape and type of cleavage of two different minerals.



Crystal shape: cubic
Cleavage: three directions
– all at right angles

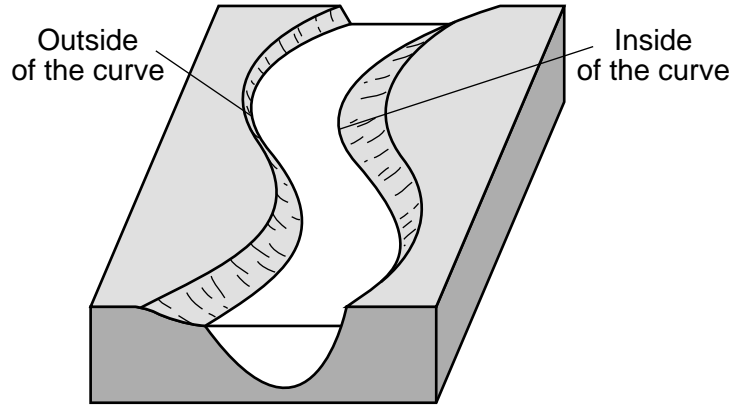


Crystal shape: rhombohedral
Cleavage: three directions
– *not* at right angles

The crystal shape and type of cleavage of these two minerals are determined mainly by the minerals'

- (1) color and type of luster
- (2) streak and hardness
- (3) composition and atomic arrangement
- (4) density and magnetism

32 The block diagram below represents a meandering stream.



Which table indicates where the greatest stream velocity and the greatest rate of stream erosion occur?

Greatest Stream Velocity	Greatest Stream Erosion
outside of the curve	outside of the curve

(1)

Greatest Stream Velocity	Greatest Stream Erosion
inside of the curve	inside of the curve

(3)

Greatest Stream Velocity	Greatest Stream Erosion
outside of the curve	inside of the curve

(2)

Greatest Stream Velocity	Greatest Stream Erosion
inside of the curve	outside of the curve

(4)

33 The diagram below represents the size and shape of a pebble. This pebble and 20 other pebbles having a similar size and shape were placed in a rock tumbler with water and allowed to abrade for five days.



Which diagram best represents the size and shape of this pebble after the five-day period?



(1)



(2)



(3)



(4)

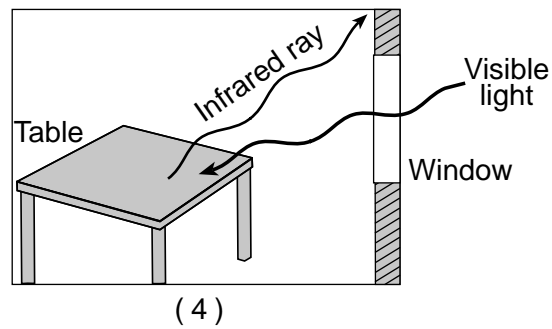
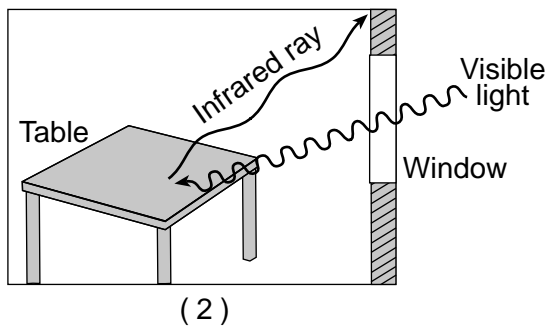
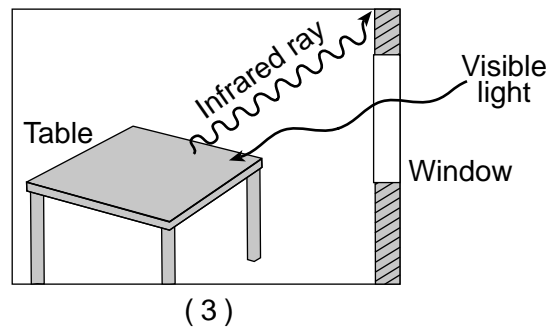
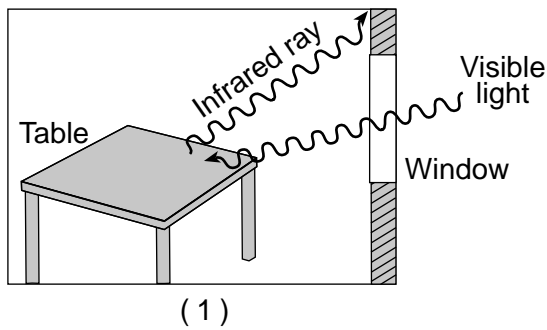
34 The photograph below shows bedrock composed of sediments that have been deposited by wind.



This bedrock is most likely

- (1) sandstone
- (2) limestone
- (3) hornfels
- (4) granite

35 Which diagram below best represents both the relative wavelength of visible light entering a house through a window and the relative wavelength of infrared rays being given off by a table within the house?

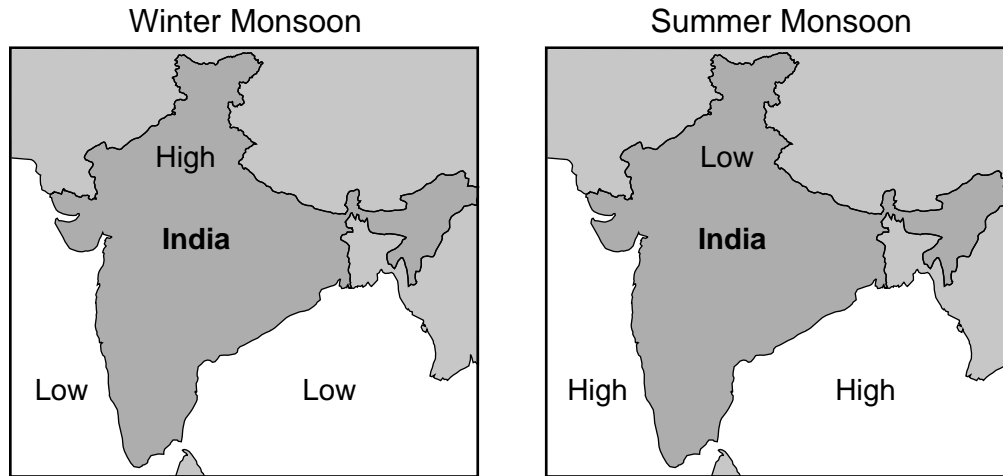


Part B-1

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 and 37 on the maps below and on your knowledge of Earth science. The maps show a portion of India and Southeast Asia, bordering on the Indian Ocean, during the winter and summer monsoon seasons. Large areas of high and low air pressure are shown during each season.



36 Which two-letter symbol represents the most likely air mass formed over portions of the Indian Ocean shown on the maps?

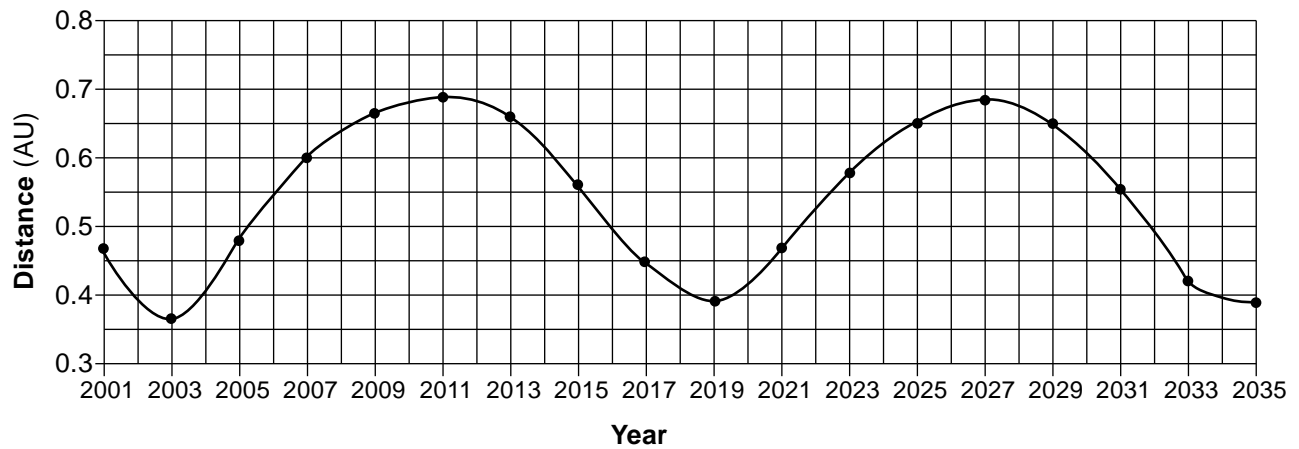
- (1) mP
- (2) mT
- (3) cP
- (4) cT

37 The heavy monsoon rains affecting India and Southeast Asia occur during

- (1) winter, when winds blow from the land
 - (2) winter, when winds blow toward the high pressure
 - (3) summer, when winds blow from the ocean
 - (4) summer, when winds blow toward the high pressure
-

Base your answers to questions 38 through 40 on the graph below and on your knowledge of Earth science. The graph shows the closest distance between Earth and Mars during each year from 2001 to 2035. Distances are measured in astronomical units (AU). One AU equals the average distance from Earth to the Sun.

Closest Distance Each Year Between Earth and Mars



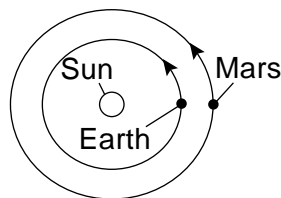
38 Mars reaches its closest distance to Earth approximately every

- (1) 16 years
- (2) 8 years
- (3) 3 years
- (4) 0.36 years

39 How many million kilometers is one astronomical unit?

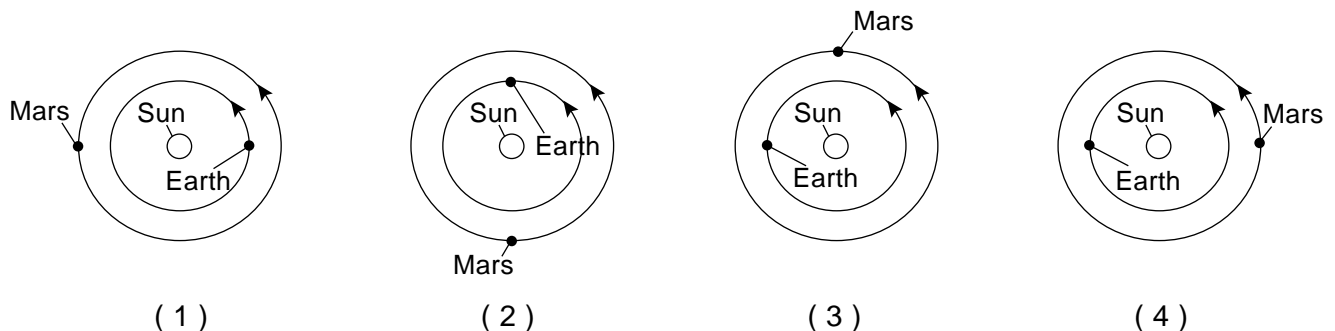
- (1) 108.2 million km
- (2) 149.6 million km
- (3) 227.9 million km
- (4) 377.5 million km

40 The diagram below represents the positions of Earth and Mars in their orbits around the Sun when they were closest in the year 2003.

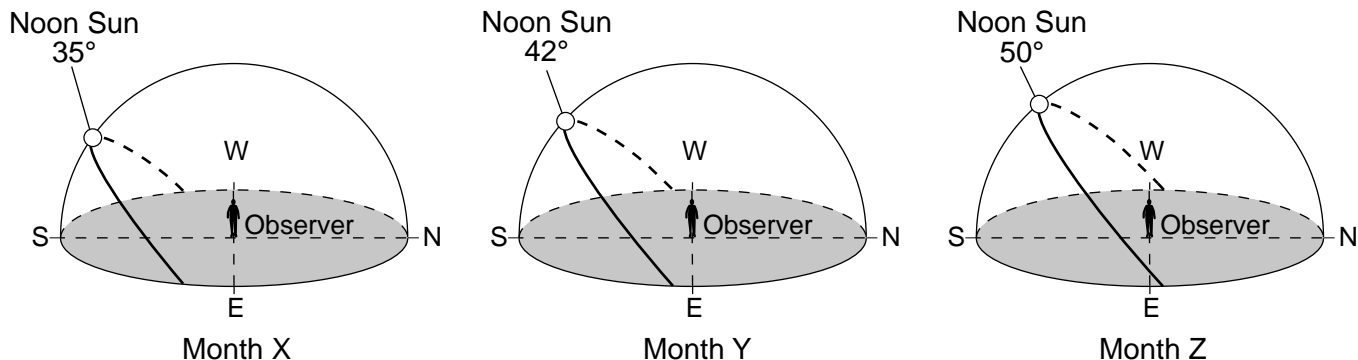


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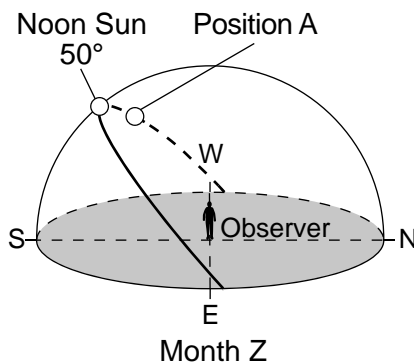
Which diagram represents the positions of Earth and Mars approximately one-half of an Earth year (183 days) later?



Base your answers to questions 41 through 44 on the three Sun's path diagrams below and on your knowledge of Earth science. The diagrams represent the position of the noon Sun along its apparent daily path as seen by an observer on the first day of three consecutive months (X, Y, and Z). The observer was located in Utica, New York.

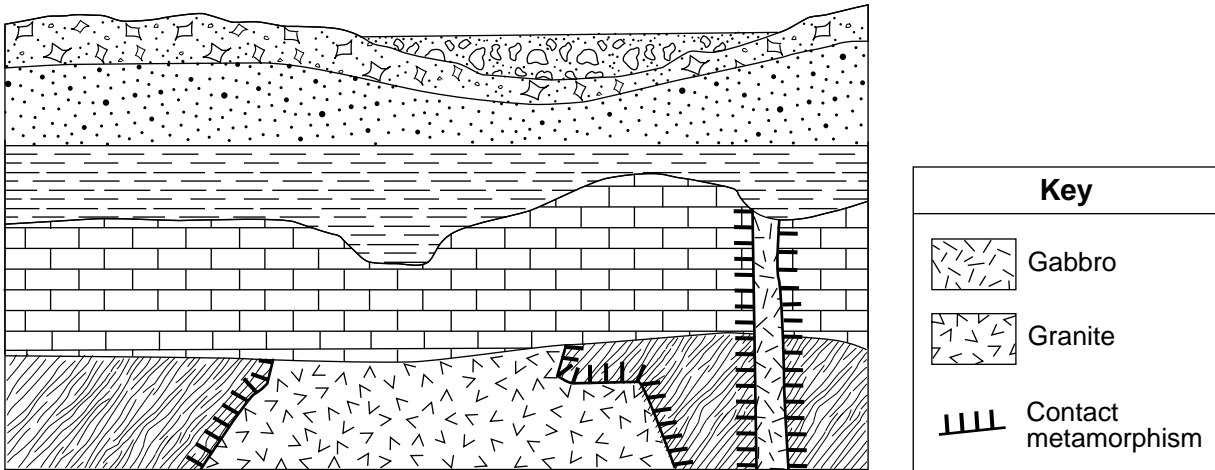


- 41 Which dates are represented by months X, Y, and Z?
- (1) X-February 1, Y-March 1, Z-April 1
 (2) X-May 1, Y-June 1, Z-July 1
 (3) X-August 1, Y-September 1, Z-October 1
 (4) X-November 1, Y-December 1, Z-January 1
- 42 Which characteristic of the Sun's apparent daily path stays constant from month X to month Z?
- (1) locations of sunrise and sunset
 (2) altitude of the noon Sun
 (3) length of time that the Sun moves along its apparent path
 (4) rate of the Sun's movement along its apparent path
- 43 For an observer in the Southern Hemisphere at 43° S latitude, the highest altitude of the noon Sun occurs when the Sun is above the
- (1) eastern horizon
 (2) western horizon
 (3) northern horizon
 (4) southern horizon
- 44 Position A represents the position of the Sun at another time of day during month Z. What is the time of day when the Sun is at position A?



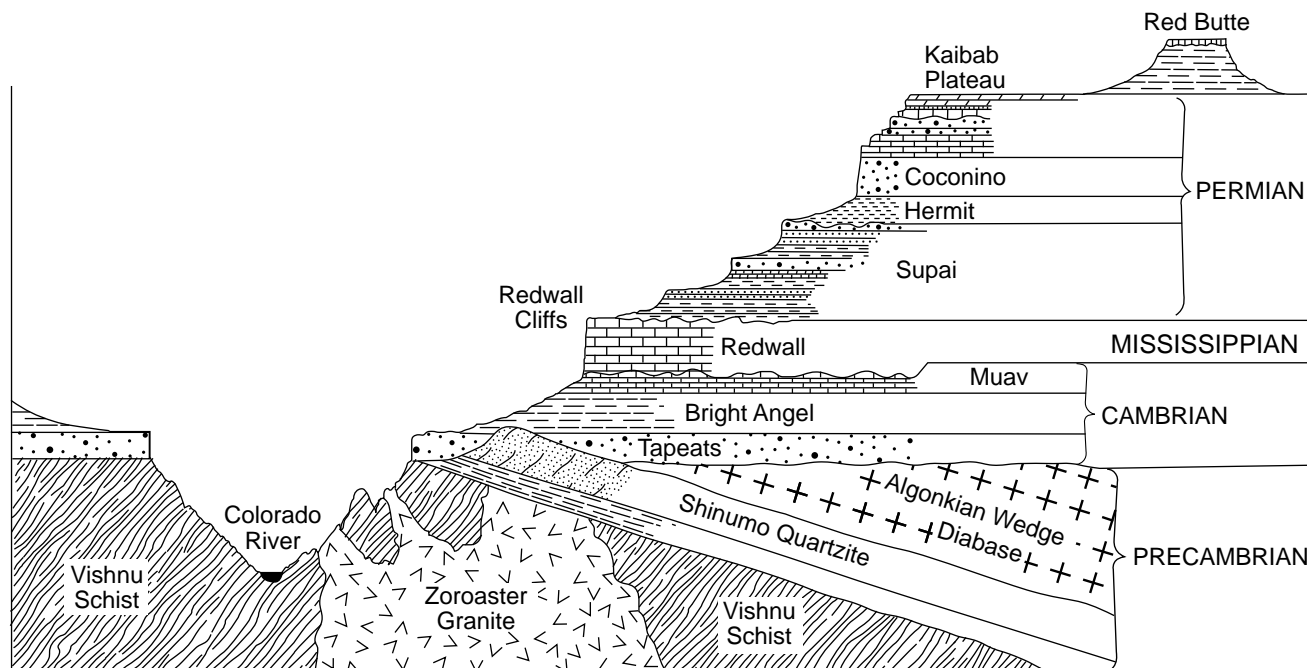
- (1) 1 p.m.
 (2) 5 p.m.
 (3) 7 a.m.
 (4) 11 a.m.

Base your answers to questions 45 through 47 on the geologic cross section of a portion of Earth's crust shown below and on your knowledge of Earth science. None of the rock units has been overturned.



- 45 The youngest rock unit shown in the cross section is
- (1) breccia (2) conglomerate (3) sandstone (4) shale
- 46 Which process most probably produced the irregularly shaped boundary between the limestone and the shale?
- (1) folding (2) faulting (3) contact metamorphism (4) erosion
- 47 Which sequence shows the relative ages of the gabbro, granite, and schist from oldest to youngest?
- (1) gabbro → granite → schist (2) gabbro → schist → granite (3) schist → granite → gabbro (4) schist → gabbro → granite
-

Base your answers to questions 48 through 50 on the cross section below and on your knowledge of Earth science. The cross section represents the landscape features and rock units of the Grand Canyon region in the southwestern United States. The names and ages of some rock formations are shown.



48 Which agent of erosion is mainly responsible for the formation of the Grand Canyon?

- (1) running water
- (2) glacial ice
- (3) wind
- (4) wave action

49 Approximately how many million years ago (mya) was the Coconino sandstone deposited as sediment?

- (1) 180 mya
- (2) 275 mya
- (3) 330 mya
- (4) 495 mya

50 If the climate of the Grand Canyon region became more humid, the rate of weathering and erosion would most likely

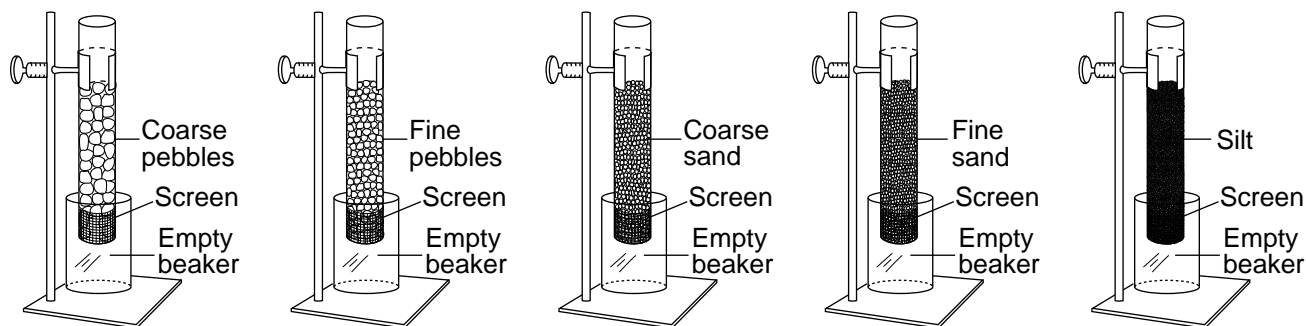
- (1) decrease, and the landscape features would become more rounded
- (2) decrease, and the landscape features would become more angular
- (3) increase, and the landscape features would become more rounded
- (4) increase, and the landscape features would become more angular

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 diagram and data table below, and on your knowledge of Earth science. The diagram represents the laboratory materials used for an investigation of the effects of particle size on water retention. Five separate columns were filled to the same level with particles. The particle type is indicated for each column. The particles within each column are of uniform shape. A volume of 50 milliliters (mL) of water was poured through each column, and the amount of water retained was determined. The data table shows the results of this experiment.



(Not drawn to scale)

Water Retention

Particle Type (size)	Water Retained (mL)
Coarse pebbles	7
Fine pebbles	15
Coarse sand	32
Fine sand	38
Silt	46

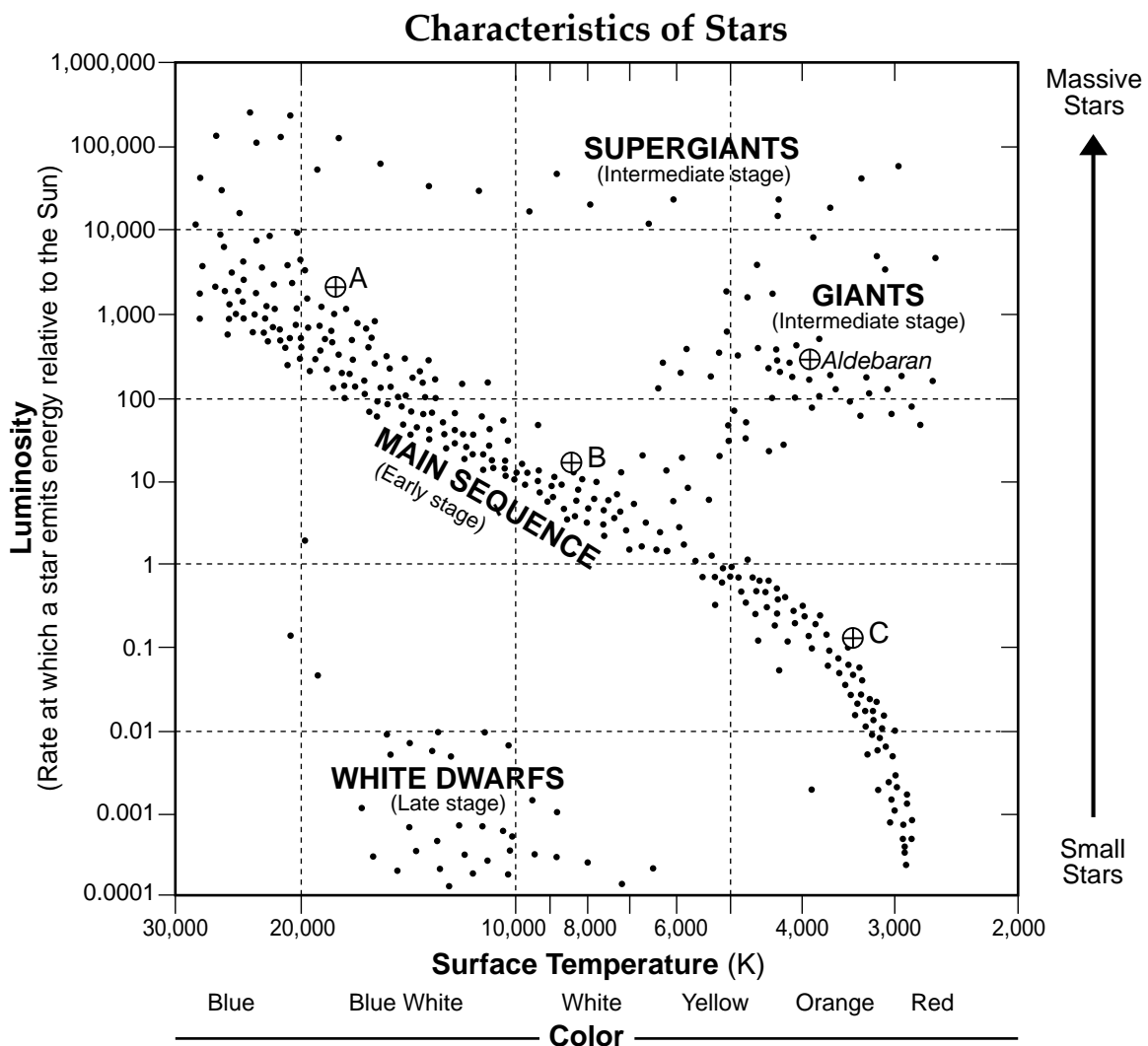
- 51 Describe the general relationship between particle size and the amount of water retained. [1]
- 52 Name the particle type used in the investigation that most likely had the greatest permeability when the 50 milliliters of water were poured through these columns. [1]
-

Base your answers to questions 53 through 55 on the passage and the Characteristics of Stars graph below, and your knowledge of Earth science. Letters A, B, and C represent main sequence stars on the graph. The giant star *Aldebaran* is also shown.

Globular Star Clusters

Globular star clusters appear as small, hazy spots among the other stars. These clusters are groups of hundreds of thousands of stars held together by gravity. Individual stars within a cluster can be seen by using powerful telescopes, allowing scientists to determine their luminosities and temperatures.

All of the stars in a given cluster formed at the same time. In young clusters, most of the stars are classified as main sequence stars. As the stars in a cluster age, they eventually use up their core hydrogen and expand, changing from main sequence stars to giants. The most massive main sequence stars become supergiants. The less massive a star is in the cluster, the longer it remains a main sequence star. Over time, the number of main sequence stars in a cluster decreases.



- 53 Compared to the relative amount of time that star *A* remains in the main sequence, state how the relative amount of time that star *C* remains in the main sequence is different. Explain why this amount of time is different. [1]
- 54 The globular star cluster containing stars *A*, *B*, and *C* is located in the same galaxy as our Sun. Identify the name of this galaxy. [1]
- 55 Identify the nuclear process that uses up a star's core hydrogen and produces the energy released by stars in a globular cluster. [1]
-

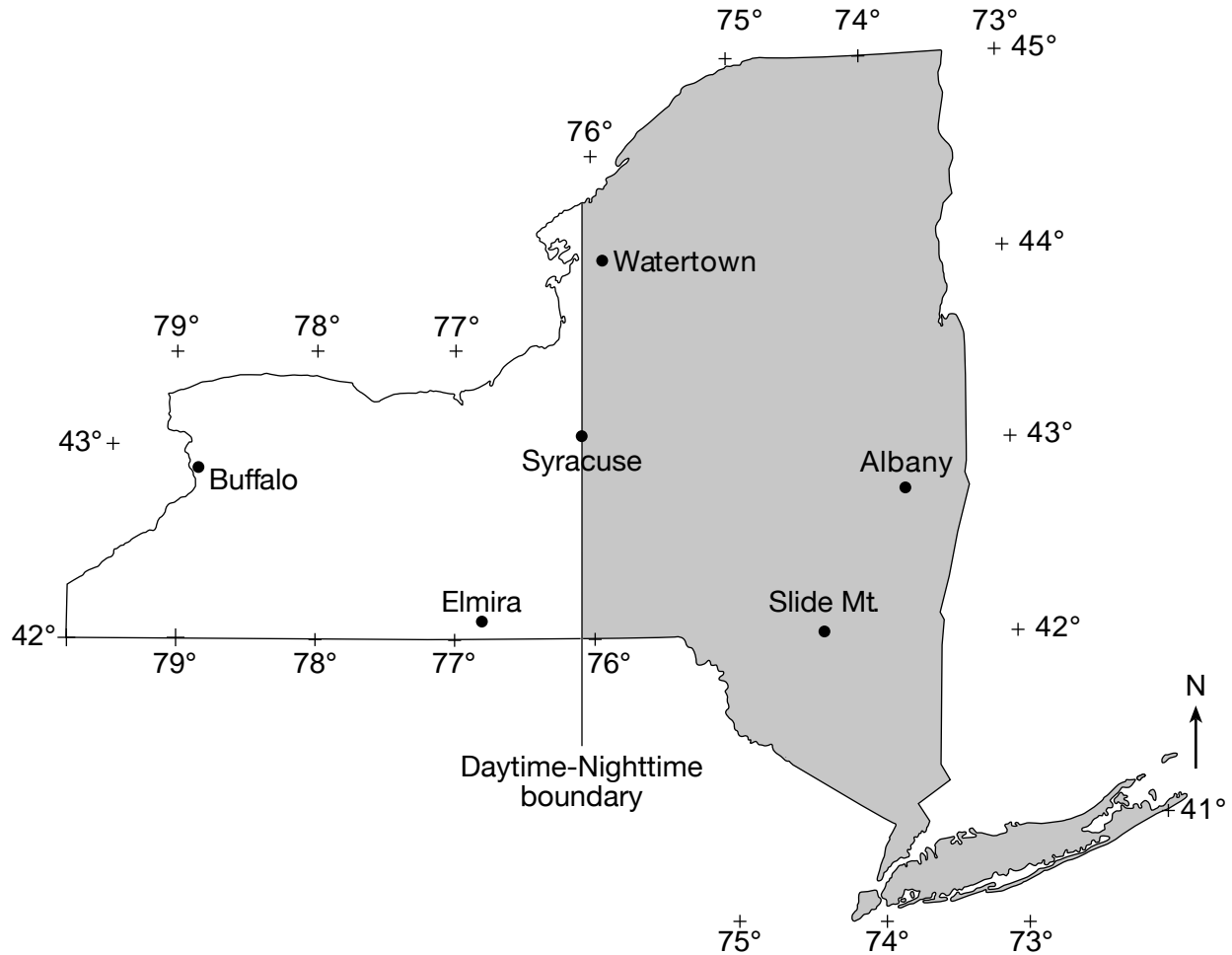
Base your answers to questions 56 through 58 on the topographic map in your answer booklet and on your knowledge of Earth science. Points *A* and *B* represent locations on Earth's surface. Elevations are shown in feet. The 50-ft and 55-ft contour lines are *not* shown on the map.

- 56 On the map *in your answer booklet*, draw the 50-ft and 55-ft contour lines. The contour lines must extend to the edges of the map. [1]
- 57 Calculate the gradient between points *A* and *B*. [1]
- 58 Identify the general compass direction toward which Ames Stream flows. Describe the contour line evidence shown on the map that supports your answer. [1]
-

Base your answers to questions 59 through 61 on the map in your answer booklet and on your knowledge of Earth science. The map shows an imaginary continent on a planet that has climate conditions similar to Earth. The continent is surrounded by oceans. Points *A* through *D* represent locations on the continent.

- 59 On the map *in your answer booklet*, draw one curved arrow between 0° and 30° N to indicate the direction of prevailing planetary winds between these latitudes. [1]
- 60 Compared to the average air temperature and the average moisture conditions at *A*, describe how the relative average air temperature and the relative average moisture conditions at *B* are different. [1]
- 61 Identify the primary factor that causes location *C* to have a colder climate than location *D*. [1]
-

Base your answers to questions 62 through 65 on the map below and on your knowledge of Earth science. The map shows areas of daylight and darkness in New York State on March 21. Six locations are labeled on the map.



- 62 Identify the Earth motion that causes the daytime-nighttime boundary to appear to move. [1]
- 63 State the number of hours of nighttime that people in Syracuse will experience on March 21. [1]
- 64 State the name of the location labeled on this map where sunset will next be observed after Syracuse. [1]
- 65 State the altitude of *Polaris* as seen by an observer on Slide Mountain. [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 map and passage below and on your knowledge of Earth science. The map shows isolines that represent the thickness of a portion of the Greenland Ice Sheet in meters (m). Letters *A* and *B* represent points on the ice sheet's surface.

Thickness of Greenland Ice Sheet



Greenland Ice Sheet

The Greenland Ice Sheet is a vast body of ice covering roughly 80 percent of the surface of Greenland. The ice sheet is almost 2400 kilometers long in a north-south direction. The ice sheet, consisting of layers of snow compressed over more than 100,000 years, contains a valuable record about Earth's past climates. The ice sheet glaciers continue to flow seaward and deposit sediment, but global warming has affected them. Warmer air temperatures have caused increased melting, resulting in a thinning of the ice sheet and faster glacial movement at the ice sheet edges.

- 66 On the grid *in your answer booklet*, construct a profile along line *AB* by plotting the thickness of the ice sheet where each isoline crosses line *AB*. Thicknesses of the ice sheet at *A* and *B* have been plotted on the grid. Connect *all twelve* plots with a line from *A* to *B* to complete the profile. [1]
- 67 Describe *one* glacial feature that could be found on the exposed surface bedrock of Greenland that would indicate the direction that the ice moved. [1]
- 68 Identify *two* major greenhouse gases that are inferred to contribute to global warming and increased temperatures in Greenland. [1]

Base your answers to questions 69 through 71 on the data table below, on the graph in your answer booklet, and on your knowledge of Earth science. The data table shows the percentage of the stable disintegration product produced over time by the radioactive decay of isotope X after each half-life. The graph shows the percentage of radioactive isotope X remaining over time during the radioactive decay of isotope X.

Disintegration Product of Isotope X

Percentage of Stable Disintegration Product (%)	Time (years)	Number of Half-Lives
0	0	0
50	5700	1
75	11,400	2
87.5	17,100	3
93.75	22,800	4

69 On the graph *in your answer booklet*, plot the percentage of stable disintegration product for each of the times shown on the data table and connect *all five* plots with a line. [1]

70 Determine the number of years (y) it takes for only 25% of radioactive isotope X to remain in a sample. [1]

71 Identify radioactive isotope X and its stable disintegration product. [1]

Base your answers to questions 72 through 75 on the diagram in your answer booklet and on your knowledge of Earth science. The diagram represents two positions of the Moon as it orbits Earth. Positions 1 and 2 are on opposite sides of Earth. Point C represents the location of a crater on the Moon's surface when the Moon is at position 1.

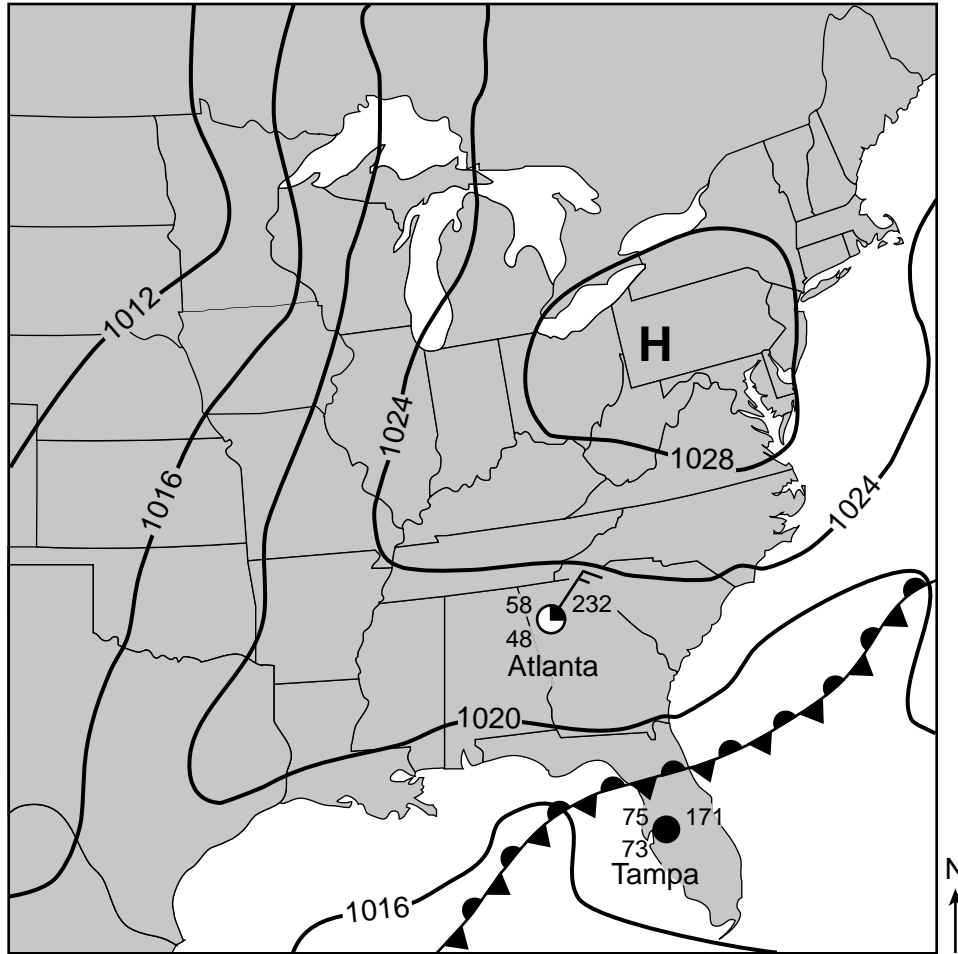
72 On the diagram *in your answer booklet*, draw a dot (•) on the Moon at position 2 to indicate the location of crater C when the Moon is at position 2. [1]

73 On the diagram *in your answer booklet*, place an **X** on the Moon's orbit to indicate the position of the Moon when a lunar eclipse could be viewed from Earth. [1]

74 Determine the number of days needed for the Moon to move from position 1 to position 2, completing one-half of its orbit. [1]

75 On the diagram *in your answer booklet*, shade the portion of the Moon that is in darkness as viewed from New York State when the Moon is at position 1. [1]

Base your answers to questions 76 through 78 on the weather map below and on your knowledge of Earth science. On the weather map, the location of the center of a high-pressure system (H) and a front are shown. Isobar values are labeled in millibars (mb). Weather station models represent the weather conditions at Atlanta, Georgia, and Tampa, Florida.

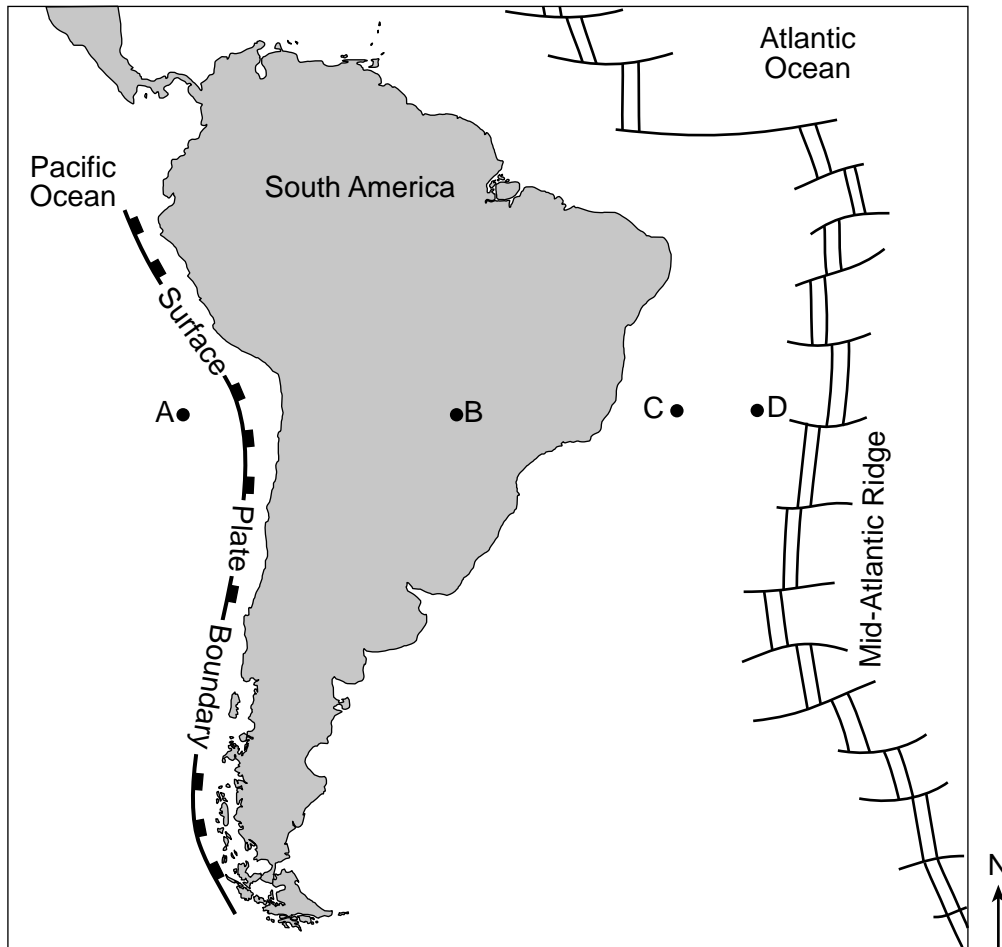


76 Complete the table *in your answer booklet* with the actual weather conditions represented by the weather station model at Atlanta, Georgia. [1]

77 Identify the type of front shown on the map. [1]

78 Describe *one* piece of evidence shown on the map that indicates that Tampa, Florida, has a high probability of precipitation. [1]

Base your answers to questions 79 through 81 on the map below and on your knowledge of Earth science. The map shows the surface location of a tectonic plate boundary along the western coast of South America. The Mid-Atlantic Ridge is also shown. Points A through D represent locations on Earth's surface.

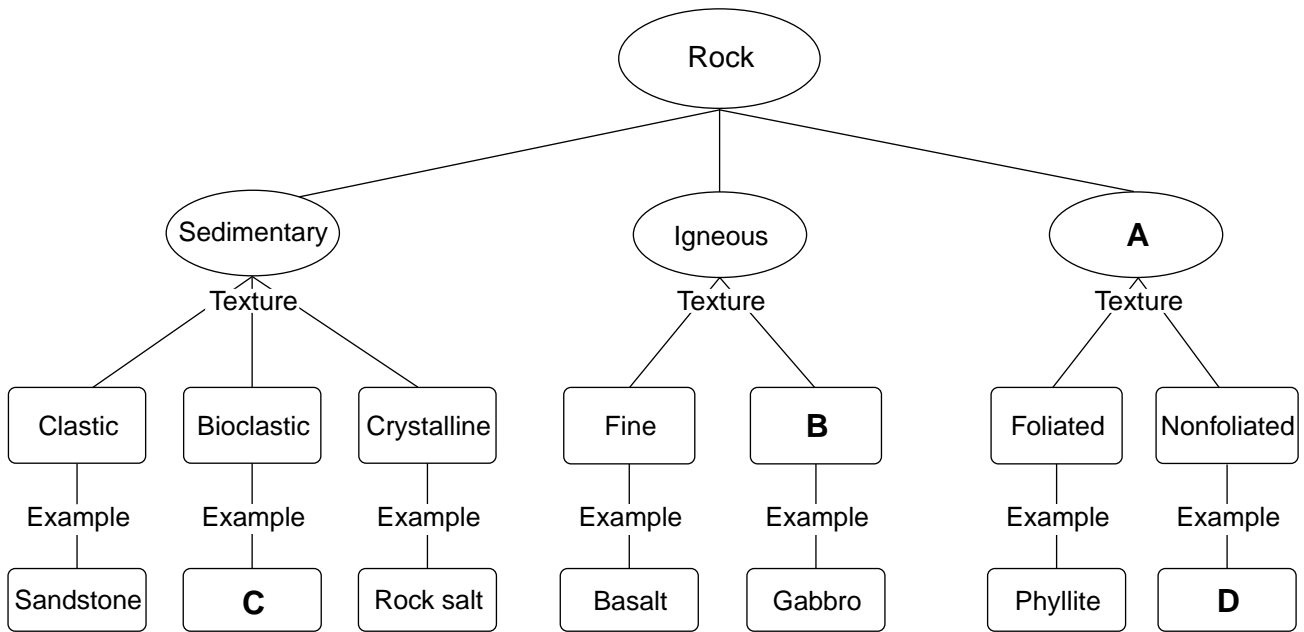


79 Identify the names of the tectonic plates at locations A and B. [1]

80 Compared to the relative age of the surface oceanic bedrock at location C, state the relative age of the surface oceanic bedrock at location D. Explain why this difference in relative age occurs. [1]

81 Identify the term for the large ocean wave produced by offshore earthquakes that is hazardous to humans living along the west coast of South America. Describe *one* emergency action that should be taken to avoid loss of life when a warning for an approaching large wave has been given. [1]

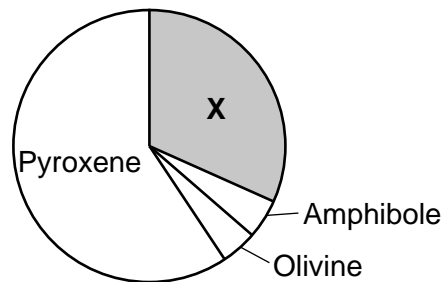
Base your answers to questions 82 through 85 on the flowchart below and on your knowledge of Earth science. Letters *A* through *D* represent information that is missing in the chart.



82 Complete the table *in your answer booklet* by writing the missing information represented by letters *A* through *D*. [1]

83 Identify the *two* elements that make up the chemical composition of the mineral in rock salt. [1]

84 The pie graph below shows the percentages of four minerals that compose the igneous rock gabbro. Letter *X* represents one of the minerals.



Identify the mineral represented by letter *X* in the graph. [1]

85 Identify the name of *one* foliated rock formed when phyllite undergoes increased heat and pressure. [1]

FOR TEACHERS ONLY

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

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

Thursday, January 25, 2018 — 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 1	10 2	19 4	28 1
2 3	11 1	20 4	29 3
3 4	12 4	21 3	30 1
4 3	13 1	22 2	31 3
5 4	14 4	23 2	32 1
6 2	15 2	24 3	33 4
7 4	16 3	25 4	34 1
8 1	17 4	26 2	35 2
9 2	18 3	27 3	

Part B–1

36 2	40 3	44 1	48 1
37 3	41 1	45 2	49 2
38 1	42 4	46 4	50 3
39 2	43 3	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 Thursday, January 25, 2018. 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. Acceptable responses include, but are not limited to:
- As particle size decreases, the amount of water retained increases.
 - The smaller particles retained more water.
 - Larger particles retain less water.
 - inverse relationship

- 52 [1] Allow 1 credit for coarse pebbles.

Note: Do *not* allow credit for pebbles alone. (This is not specific enough for choosing an answer from the data table.)

- 53 [1] Allow 1 credit if *both* responses are correct. Acceptable responses include, but are not limited to:

Relative time for star C:

- stays in main sequence longer
- greater amount of time/more time
- Star A leaves the main sequence sooner.

Explanation:

- Star C is less massive/smaller.
- It is cooler.
- Star C uses up its core hydrogen more slowly.
- Star A is more massive/larger.
- The less massive a star is in the cluster, the longer it remains a main sequence star.

- 54 [1] Allow 1 credit for Milky Way *or* Milky Way galaxy.

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

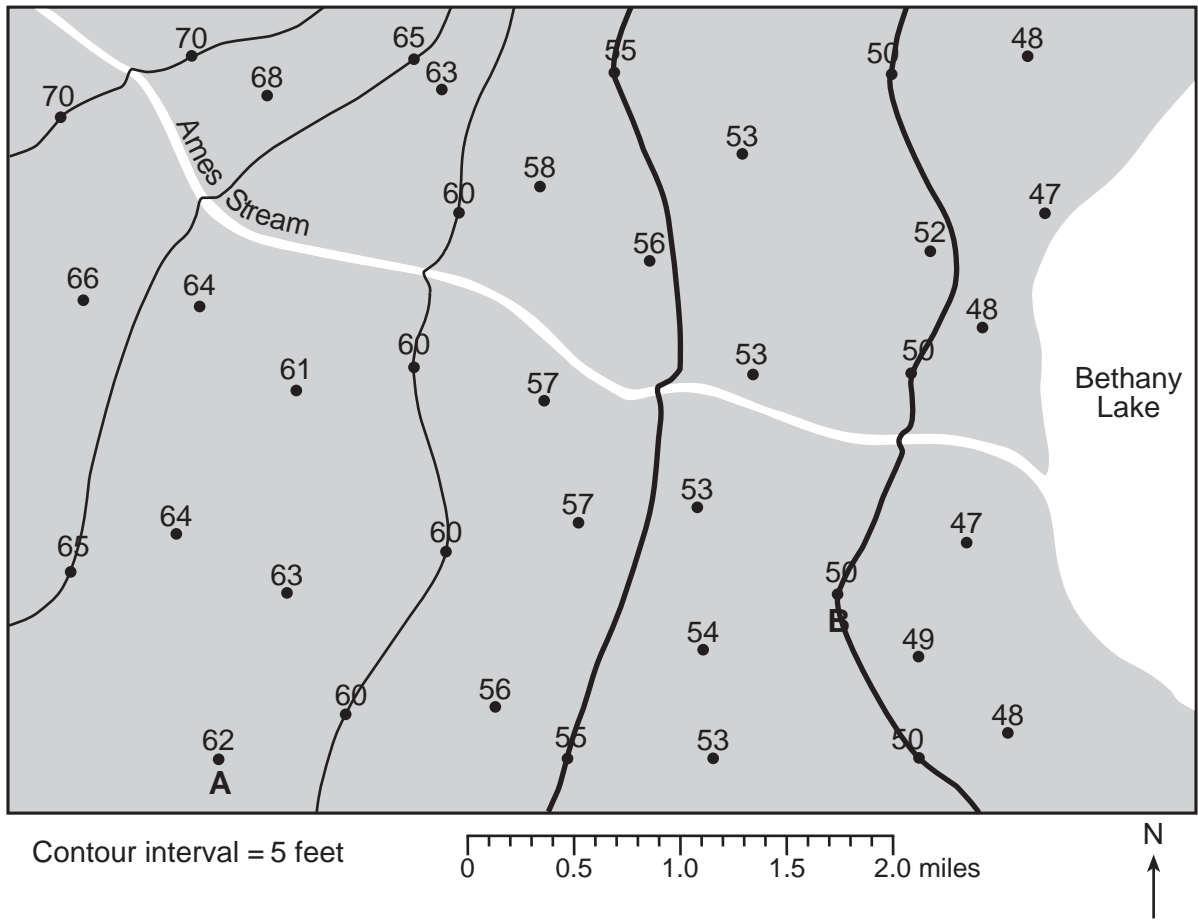
- nuclear fusion
- fusion
- Hydrogen atoms combine to form helium.
- Lighter elements change into a heavier element.

56 [1] Allow 1 credit for correctly drawing *both* the 50-ft and 55-ft contour lines to the edges of the map.

Note: Allow credit even if the student's lines do *not* make a V-shape when the stream is crossed.

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

Example of a 1-credit response:



57 [1] Allow 1 credit for any value from 3.87 to 4.14 ft/mi *or* any value from -3.87 to -4.14 ft/mi.

58 [1] Allow 1 credit if *both* the compass direction and evidence are correct. Acceptable responses include, but are not limited to:

Compass direction:

- southeast/SE
- east
- ESE

Evidence:

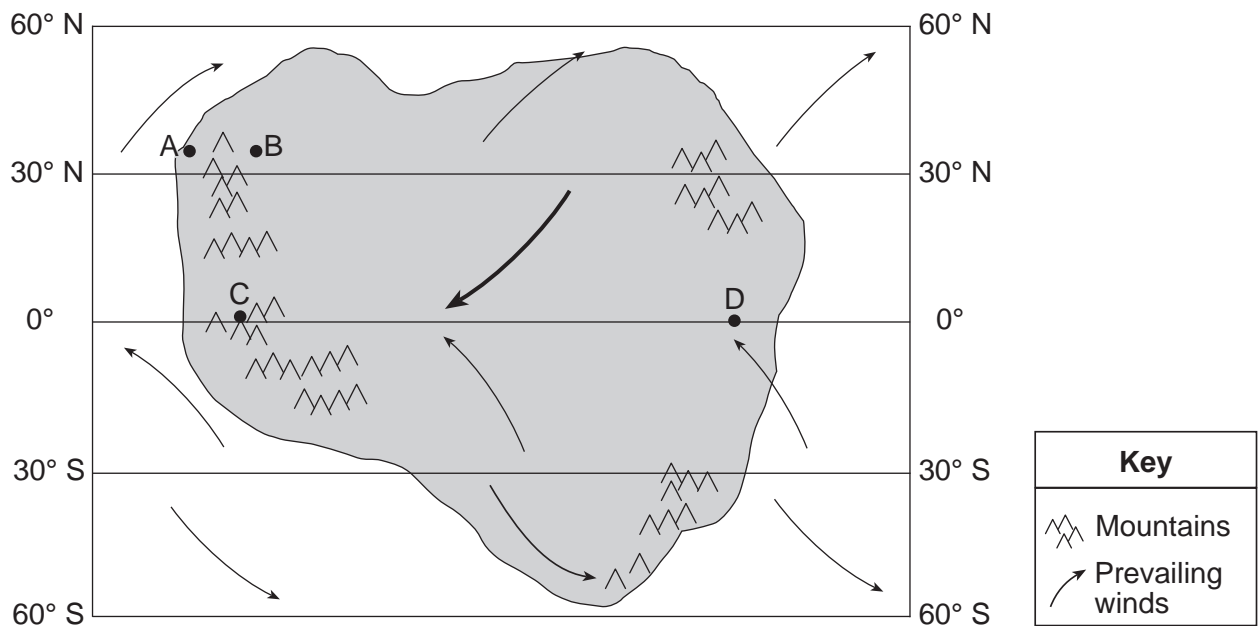
- The stream flows from a higher contour line elevation in the west to a lower contour line elevation in the east.
- Contour lines bend upstream when they cross a stream; streams flow in the opposite direction.
- Contour lines make a V-shape that points uphill where they cross a stream/law of the Vs.
- The contour lines point uphill.
- Streams flow out of the open end of the Vs.
- This stream flows from a higher elevation to a lower elevation.

Note: Do *not* allow credit for “water flows downhill” because this does not indicate how contour lines show stream direction.

59 [1] Allow 1 credit for an arrow drawn curving to the right from northeast to southwest between 30° N and 0°.

Note: If more than one curved arrow is drawn, *all* must be correctly drawn to receive credit.

Example of a 1-credit response:



60 [1] Allow 1 credit if *both* responses are correct. Acceptable responses include, but are not limited to:

Relative average air temperature at *B*:

- warmer
- hotter
- higher

Relative average moisture conditions at *B*:

- drier
- less moist/less humid
- more arid
- lower/less

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

- elevation
- altitude
- height above sea level
- Location *C* is on the top of a mountain.
- Location *D* is at a lower elevation.
- *C* is located in the mountains.

62 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- Earth's rotation
- spinning/turning on an axis
- rotation

63 [1] Allow 1 credit for 12 h.

64 [1] Allow 1 credit for Elmira.

65 [1] Allow 1 credit for 42°.

Note: Do *not* allow credit if a compass direction is given (e.g., 42 N or 42° N) because that indicates latitude, *not* altitude.

Part C

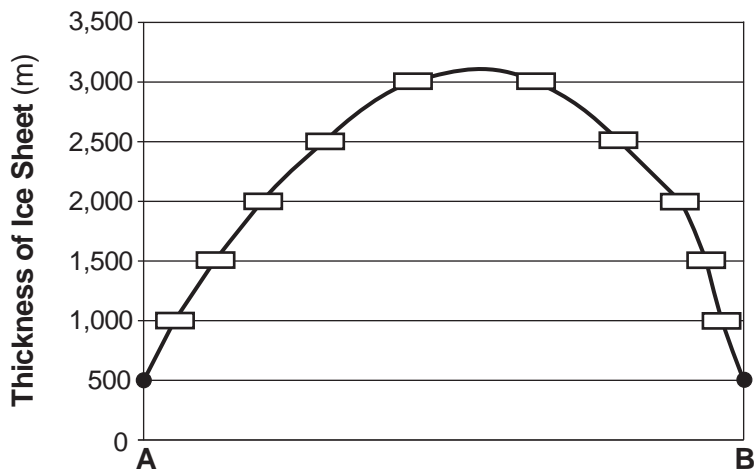
Allow a maximum of 20 credits for this part.

- 66 [1] Allow 1 credit if the centers of *all ten* student plots are located within or touch the rectangles shown below and *all twelve* plots are correctly connected with a line that passes within or touches the rectangles from point A to point B. The high point of the line must extend above 3000 m, but below 3500 m.

Note: Allow credit if the student-drawn line does *not* pass through the student 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.

Example of a 1-credit response:



- 67 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- parallel scratches/striaations on the bedrock surface
 - grooves in the bedrock
 - drumlin
 - glacial erratics
 - finger-shaped lakes
 - moraines
 - U-shaped valleys
 - outwash plains
 - eskers

68 [1] Allow 1 credit if *both* gases are correct. Acceptable responses include, but are not limited to:

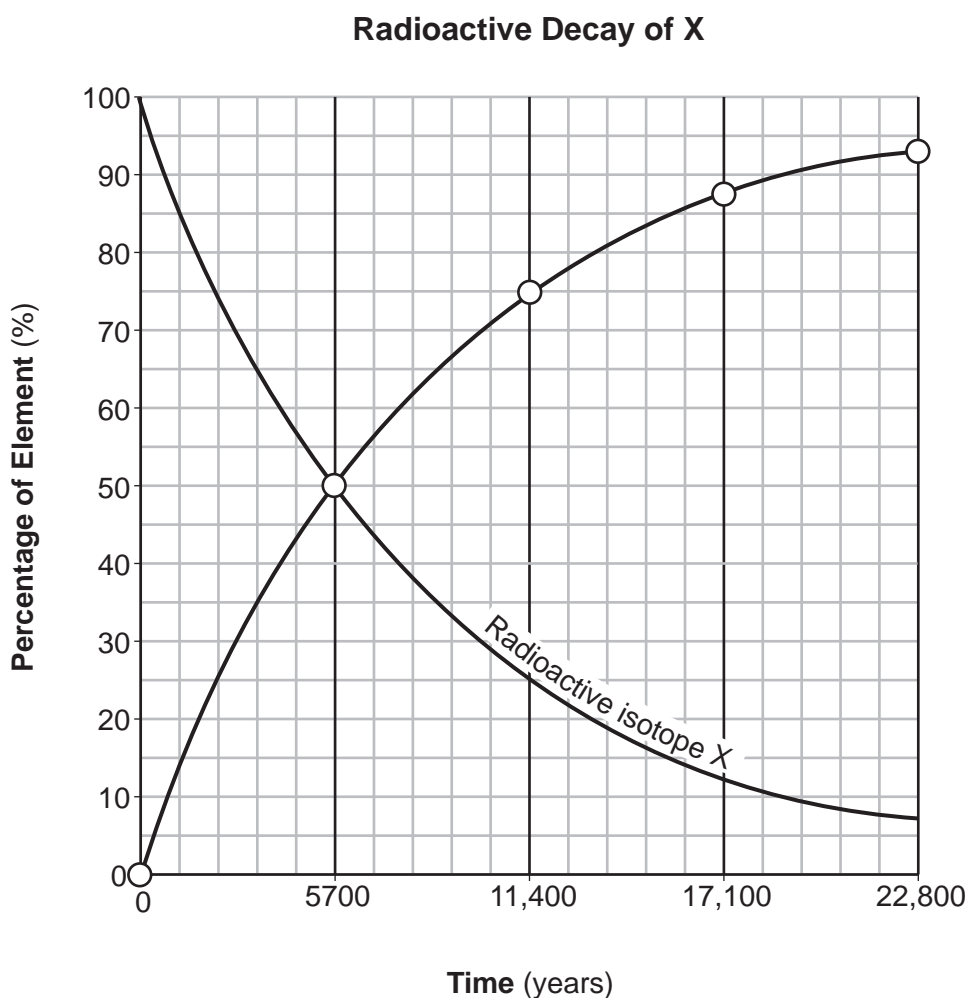
- carbon dioxide *or* CO_2
- methane *or* CH_4
- water vapor *or* $\text{H}_2\text{O}(\text{g})$
- ozone *or* O_3
- nitrous oxide *or* N_2O
- chlorofluorocarbons/CFCs

69 [1] Allow 1 credit if the centers of *all five* 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 student-drawn line does *not* pass through the student 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 11,400 y.

71 [1] Allow 1 credit if *both* responses are correct. Acceptable responses include, but are not limited to:

Radioactive isotope:

— Carbon-14/C-14

— ^{14}C

Stable disintegration product:

— Nitrogen-14/N-14

— ^{14}N

— $^{14}\text{C} \rightarrow ^{14}\text{N}$

Note: Do *not* allow credit for “carbon” and “nitrogen” alone because these elements have more than one isotope, and the specific radioactive isotope and stable disintegration product are needed.

72 [1] Allow 1 credit if the center of the dot is located within or touches the clear banded area at position 2 shown below.

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

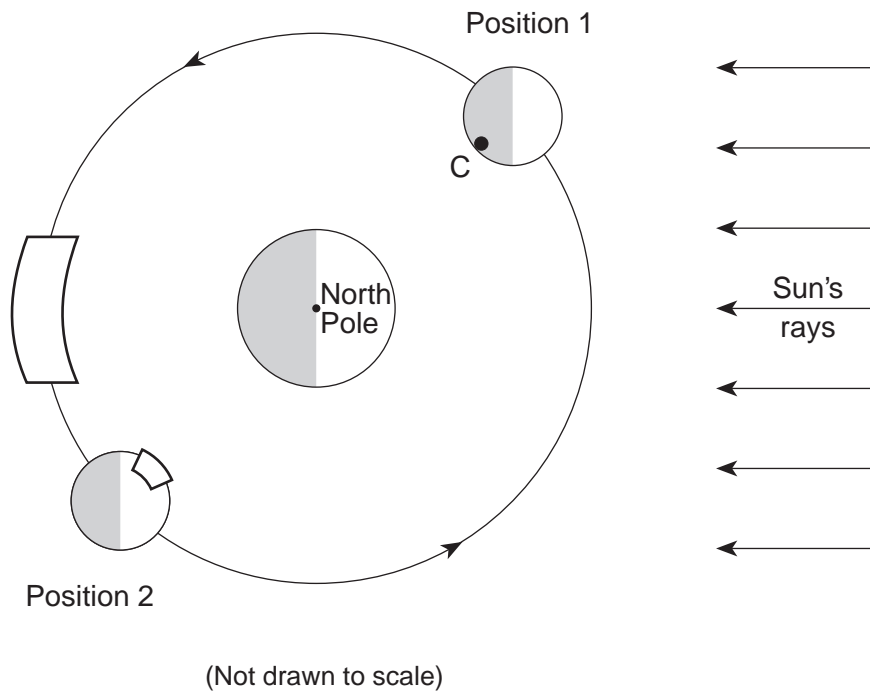
It is recommended that an overlay of the same scale as the student answer booklet be used to ensure reliability in rating.

73 [1] Allow 1 credit if the center of the student's **X** is within or touches the clear banded area on the Moon's orbit 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.

Example of a 2-credit response for questions 72 and 73:



74 [1] Allow 1 credit for any value from 13 d to 14 d.

75 [1] Allow 1 credit if the student shades more than half of the Moon, leaving a lighted portion on the right edge as shown below.

Examples of 1-credit responses:



76 [1] Allow 1 credit if *all four* weather variables are correctly recorded, as shown below.

Atlanta, Georgia		
Weather Variable	Actual Value	
Air temperature	58	°F
Barometric pressure	1023.2	mb
Wind speed	15	knots
Wind direction	from the northeast/NE <i>or</i> NNE <i>or</i> ENE	

77 [1] Allow 1 credit for stationary front.

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

- The dewpoint and air temperature are close together./high relative humidity
- 100% cloud cover/overcast
- Tampa is close to a front.
- The air pressure is low.

79 [1] Allow 1 credit if *both* responses are correct.

Location A: Nazca Plate

Location B: South American Plate

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

Relative age at location *D*:

- younger
- more recent
- newer

Explanation:

- New seafloor is forming at the Mid-Atlantic Ridge closer to *D*.
- Location *C* is farther from an ocean ridge.
- Surface oceanic bedrock moves away from the Mid-Atlantic Ridge after forming.
- Convection currents carry older rock away from the ridge as new crust forms.
- Magma coming from the rift's volcanoes forms new basalt.
- New sea floor forms at a divergent boundary.

- 81 [1] Allow 1 credit for tsunami *and* an acceptable emergency action. Acceptable responses include, but are not limited to:

Emergency action:

- Evacuate to higher ground.
- Go to higher floors in well-built structures.
- Leave beaches and low-lying land areas.
- Move inland/away from coast.

Note: Do *not* accept “tidal wave” because a tsunami is not tidal in nature and is not caused by tides.

- 82 [1] Allow 1 credit if *all four* responses are correct as shown in the chart below. Acceptable responses include, but are not limited to:

Letter	Missing Information
A	metamorphic
B	coarse
C	limestone or bituminous coal
D	anthracite coal <i>or</i> hornfels <i>or</i> quartzite <i>or</i> marble <i>or</i> metaconglomerate

Note: Do *not* allow credit for “coal” alone for *C* or *D* because it is not specific enough.

- 83 [1] Allow 1 credit for sodium/Na *and* chlorine/Cl.

- 84 [1] Allow 1 credit for plagioclase feldspar *or* plagioclase.

Note: Do *not* allow credit for “feldspar” alone because it is not specific enough.

- 85 [1] Allow 1 credit for schist *or* gneiss.

Regents Examination in Physical Setting/Earth Science

January 2018

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

The Chart for Determining the Final Examination Score for the January 2018 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, January 25, 2018. 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 2018 Physical Setting/Earth Science			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		39, 40, 57	66, 69, 74
Math Key Idea 2	10, 21, 23, 27	38, 51	70, 84
Math Key Idea 3		65	
Science Inquiry Key Idea 1	3, 8, 11, 13, 14, 18, 31	46, 47, 48, 50, 53, 54, 55, 62, 63	67, 78, 80
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3	2, 3, 4, 5, 7, 8, 10, 14, 15, 16, 17, 21, 22, 23, 24, 26, 27, 28, 29, 34, 35	36, 39, 40, 45, 49, 53, 57, 59, 65	71, 74, 76, 77, 78, 79, 82, 83, 84, 85
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			78
Key Idea 2			
Key Idea 3			81
Standard 6			
Key Idea 1	10, 32	37, 43, 50, 53	67, 80
Key Idea 2	5, 6, 9, 17, 19, 20, 24, 26, 30, 31, 32, 33, 34, 35	36, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 52, 56, 58, 59, 60, 61	66, 71, 72, 73, 75, 76, 77, 78, 79, 80, 82, 83
Key Idea 3			
Key Idea 4			
Key Idea 5	8, 9, 33	38, 43, 44, 64	70, 72, 73, 75
Key Idea 6			
Standard 7			
Key Idea 1			68
Key Idea 2			81
Standard 4			
Key Idea 1	1, 2, 3, 4, 8, 9, 15, 16, 17, 18	38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 49, 51, 52, 53, 54, 55, 62, 63, 64, 65	69, 70, 71, 72, 73, 74, 75
Key Idea 2	5, 6, 7, 10, 11, 12, 13, 14, 19, 20, 21, 22, 23, 24, 25, 26, 27, 30, 32, 33, 35	36, 37, 48, 50, 56, 57, 58, 59, 60, 61	66, 67, 68, 76, 77, 78, 79, 80, 81
Key Idea 3	28, 29, 31, 34		82, 83, 84, 85
Reference Tables			
ESRT 2011 Edition (Revised)	2, 3, 4, 5, 7, 8, 10, 14, 15, 16, 17, 21, 22, 23, 24, 26, 27, 28, 29, 34, 35	36, 39, 40, 45, 49, 57, 59, 65	71, 74, 76, 77, 78, 79, 82, 83, 84, 85

The State Education Department / The University of the State of New York
Regents Examination in Physical Setting/Earth Science – January 2018
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	94	94	93	93	92	92	91	90	90	89	88	87	86	84	83	81	79
	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	91	91	90	90	89	89	88	87	86	85	84	83	82	80	78	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	88	88	87	87	86	86	85	85	84	83	82	81	80	78	77	75	73
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	82	82	81	81	81	80	79	79	78	77	76	75	74	72	71	69	67	
57	81	81	81	80	80	79	78	78	77	76	75	74	73	71	70	68	66	
56	80	80	80	79	79	78	78	77	76	75	74	73	72	71	69	67	65	
55	80	79	79	78	78	77	77	76	75	74	73	72	71	70	68	66	65	
54	79	78	78	78	77	77	76	75	74	74	72	71	70	69	67	66	64	
53	78	78	77	77	76	76	75	74	74	73	72	71	69	68	66	65	63	
52	77	77	76	76	75	75	74	73	73	72	71	70	69	67	66	64	62	
51	76	76	75	75	75	74	73	73	72	71	70	69	68	66	65	63	61	
50	75	75	75	74	74	73	73	72	71	70	69	68	67	65	64	62	60	
49	75	74	74	73	73	72	72	71	70	69	68	67	66	65	63	61	60	
48	74	73	73	72	72	71	71	70	69	68	67	66	65	64	62	60	59	
47	73	73	72	72	71	71	70	69	68	68	67	65	64	63	61	60	58	
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 2018 – continued**

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