The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Friday, January 24, 2020 — 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

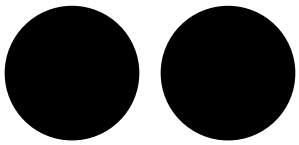
Answer all questions in this part.

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 What are two pieces of evidence that support the Big Bang Theory?

(1) red shift of light and cosmic background radiation
(2) red shift of light and the different shapes of galaxies
(3) planetary motion and cosmic background radiation
(4) planetary motion and the different shapes of galaxies

2 The diagram below compares the relative diameters of two planets in our solar system.



Which two planets have diameters that most closely resemble this comparison?

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

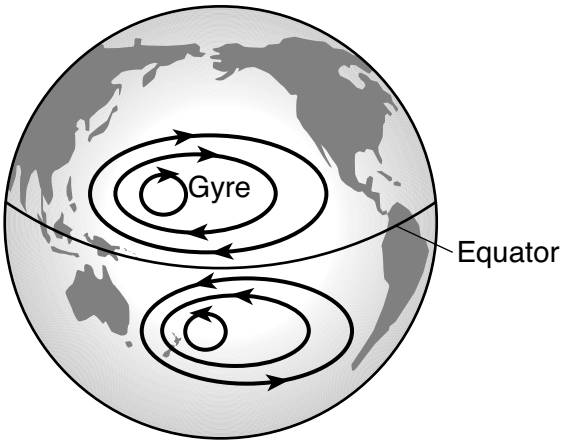
3 The motion of a Foucault pendulum provides evidence that Earth

(1) varies in distance from the Sun
(2) spins on its axis
(3) is tilted on its axis
(4) travels around the Sun

4 Which factor is a primary cause of seasonal changes on Earth?

(1) change in Earth's distance from the Sun
(2) change in the rate of Earth's rotation
(3) wobble of Earth's axis
(4) tilt of Earth's axis

5 The diagram below represents the location of gyres in the Pacific Ocean. A gyre is a circular pattern of flowing ocean currents.



Planet Earth, Understanding Science and Nature, Time Life Inc.

The clockwise direction of flow of these currents in the Northern Hemisphere, and the counterclockwise direction of flow in the Southern Hemisphere are the result of

(1) the Coriolis effect
(2) the Doppler effect
(3) Earth's magnetism
(4) the Moon's magnetism

6 Which changes in surface water movement are likely to occur when vegetation is removed from the side of a hill?

(1) infiltration decreases and runoff decreases
(2) infiltration decreases and runoff increases
(3) infiltration increases and runoff decreases
(4) infiltration increases and runoff increases

7 During which phase change will two grams of water release 668 joules of heat energy?

(1) melting
(2) freezing
(3) vaporization
(4) condensation

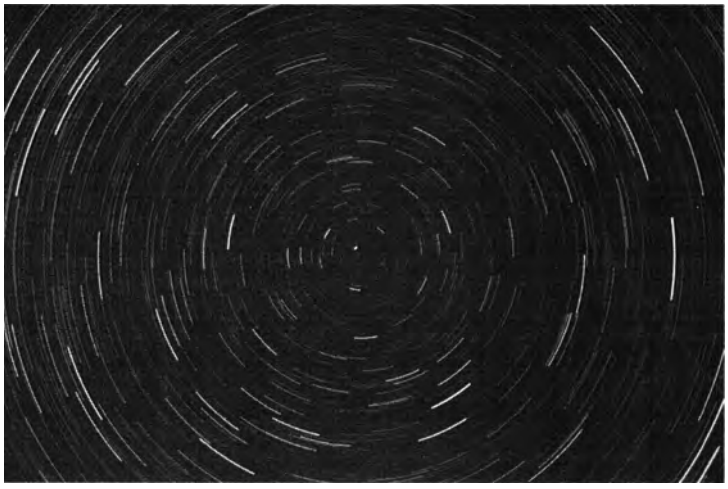
8 The chart below describes some components of the solar system.

Object	Description
X	chunk of rock and ice orbiting from the outer solar system to near the Sun
Y	streak of light seen when a space rock enters Earth's atmosphere and starts burning up
Z	rocky/metallic object orbiting the Sun between Mars and Jupiter

Letters *X*, *Y*, and *Z* identify which components of our solar system?

(1) *X* = asteroid; *Y* = meteor; *Z* = comet
(2) *X* = asteroid; *Y* = meteor; *Z* = moon
(3) *X* = comet; *Y* = meteor; *Z* = asteroid
(4) *X* = comet; *Y* = moon; *Z* = meteor

9 The time-exposure photograph shown below was taken by an observer in the Northern Hemisphere to record the apparent paths of stars.



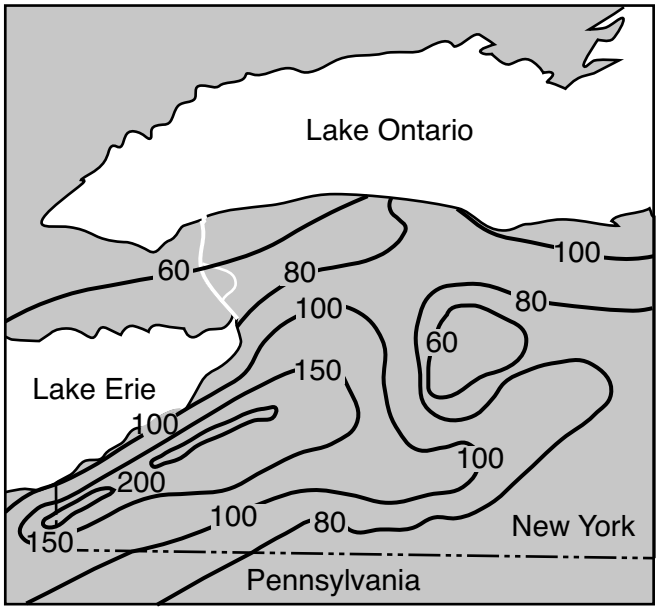
http://dianajuncher.dk/

The name of the bright star near the center that the other stars appear to be circling is

(1) *Polaris*
(2) *Alpha Centauri*
(3) *Betelgeuse*
(4) *Deneb*

10 The map below shows the average annual snowfall, in inches, for western New York State.

Average Season Snowfall in Inches



According to the map, which of these cities receives the greatest average annual snowfall?

(1) Buffalo
(2) Jamestown
(3) Niagara Falls
(4) Elmira

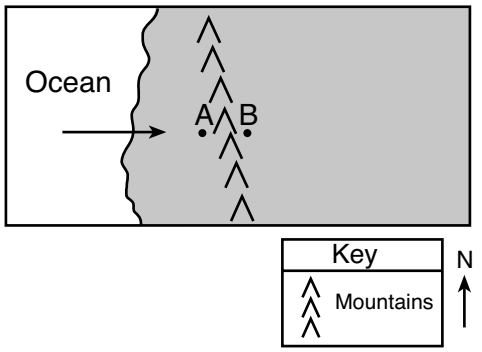
11 Which current has a warming effect on the climate of the southeast coast of Africa?

(1) Guinea Current
(2) Falkland Current
(3) Benguela Current
(4) Agulhas Current

12 Geologic history is divided into eras, periods, and epochs based on the

(1) type of rock deposited at different times throughout history
(2) half-life of radioactive isotopes found in rocks
(3) inferred movements of Earth's landmasses
(4) fossil evidence found in bedrock

13 The map below shows two locations, labeled *A* and *B*, separated by a mountain range. The locations are at the same elevation. The arrow represents the direction of prevailing winds.



Compared to the climate at location *A*, the climate at location *B* is most likely

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

14 Which important geologic event in New York State occurred just after the Grenville Mountains were starting to erode?

(1) Pangaea began to break up.
(2) The Iapetus Ocean began to open.
(3) The Catskill Delta formed.
(4) The Taconic Mountains were eroded.

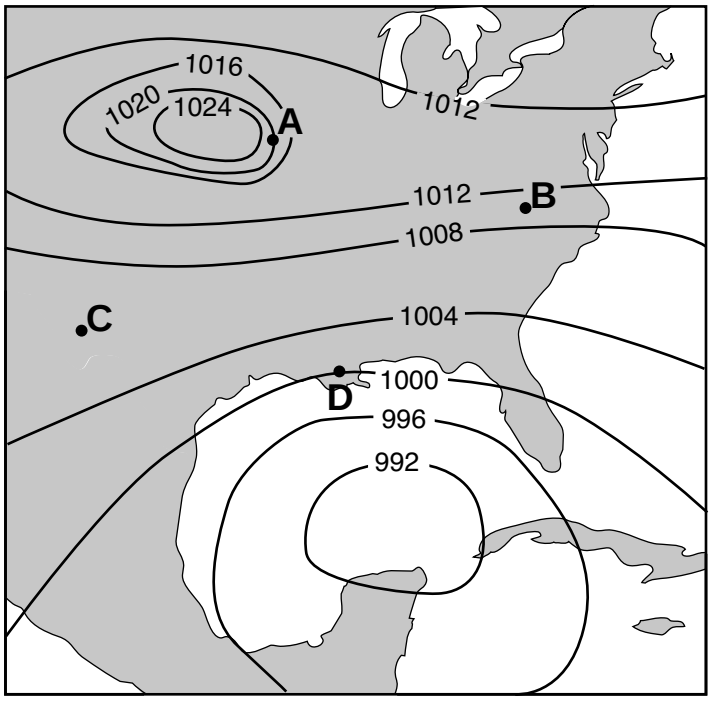
15 Scientists infer that oxygen first began to enter Earth's atmosphere after the appearance of

(1) the earliest grasses
(2) the earliest flowering plants
(3) coal-forming forests
(4) oceanic cyanobacteria

16 Which mantle hot spot is correctly matched to its overlying tectonic plate?

(1) Tasman Hot Spot–Pacific Plate
(2) Canary Island Hot Spot–Eurasian Plate
(3) St. Helena Hot Spot–South American Plate
(4) Yellowstone Hot Spot–North American Plate

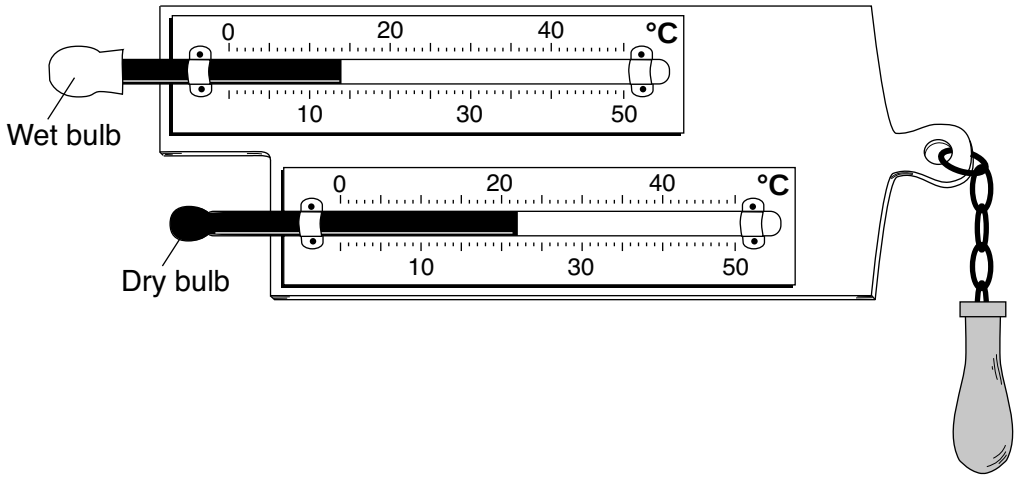
17 The weather map below shows air-pressure readings given in millibars. Points *A*, *B*, *C*, and *D* are locations on Earth's surface.



At which location is surface wind speed the *lowest*?

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

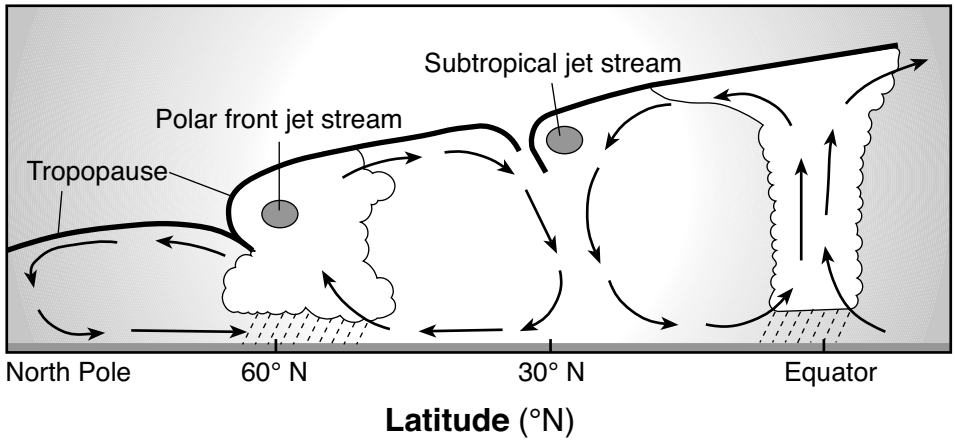
18 The diagram below shows a weather instrument used to determine relative humidity.



What is the relative humidity?

(1) 40%
(2) 36%
(3) 8%
(4) 4%

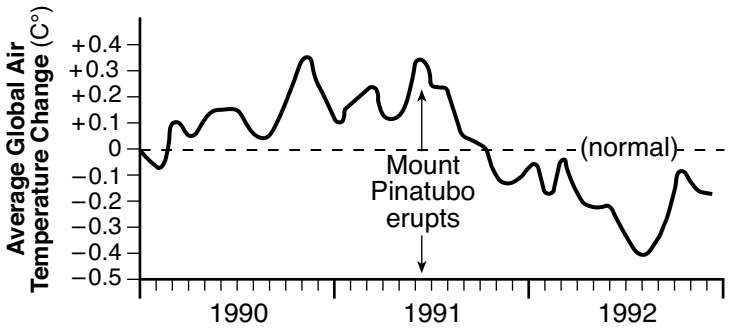
19 The diagram below shows the locations of the two major jet streams in Earth's atmosphere.



Compared to the subtropical jet stream, the polar front jet stream is at a

(1) lower latitude and lower altitude
(2) lower latitude and higher altitude
(3) higher latitude and lower altitude
(4) higher latitude and higher altitude

20 The graph below shows the average global temperature changes before and after Mount Pinatubo's eruption in the Philippines. Sulfur from volcanic eruptions, like Mount Pinatubo's, forms sulfuric acid particles in the upper atmosphere.



Adapted from: Aherns, C. Donald, *Essentials of Meteorology: An Invitation to the Atmosphere*

According to the graph, these atmospheric particles appear to have caused global air temperatures to

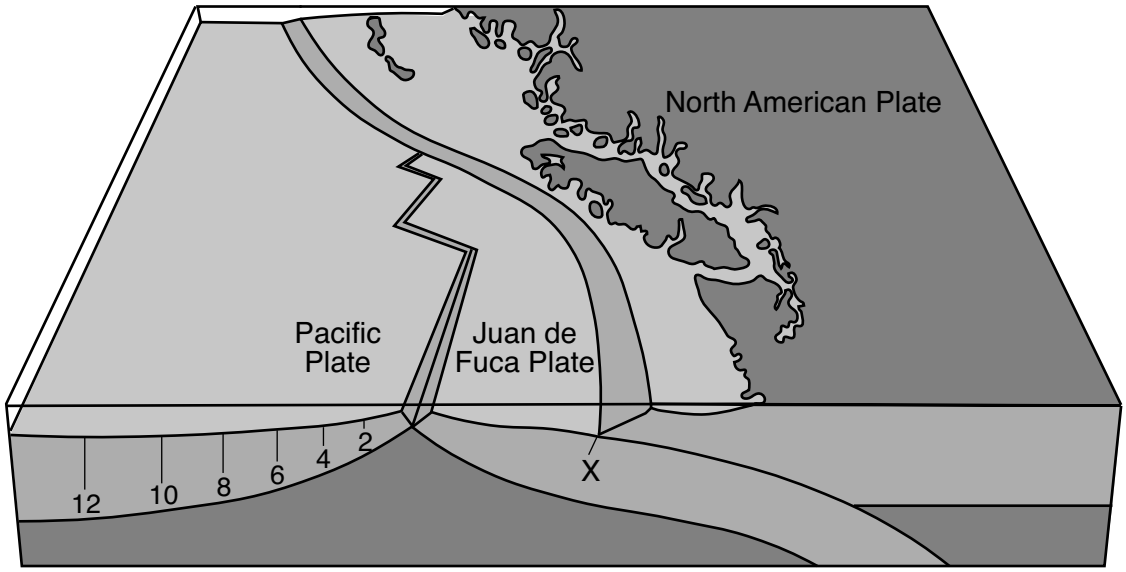
(1) generally decrease for one year
(2) decrease, but then increase to normal levels in one year
(3) generally increase for one year
(4) increase, but then decrease to normal levels in one year

21 The map below shows the location of the Chicxulub crater, which was formed when a massive asteroid impacted Earth 65.5 million years ago.

Scientists infer that this impact contributed to the extinction of

(1) trilobites
(2) gastropods
(3) many land plants
(4) placoderm fish

22 The cross section below represents the boundaries of the Pacific Plate, the Juan de Fuca Plate, and the North American Plate. The numbers show the age of the sea floor, in millions of years, at locations on the Pacific Plate. Letter *X* represents a location on the ocean floor surface.

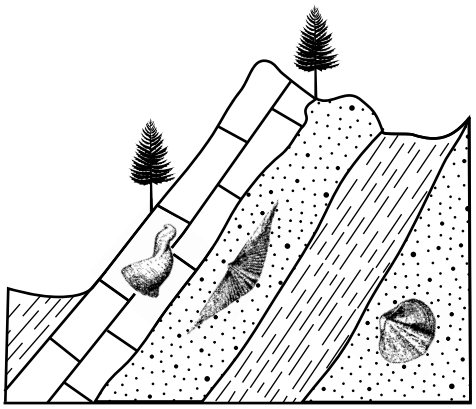


Adapted from: http://mountainculturegroup.com/

What is the most probable age of the ocean floor at location *X*, if the Pacific Plate and the Juan de Fuca Plate are moving at the same rate?

(1) 10 million years
(2) 8 million years
(3) 6 million years
(4) 4 million years

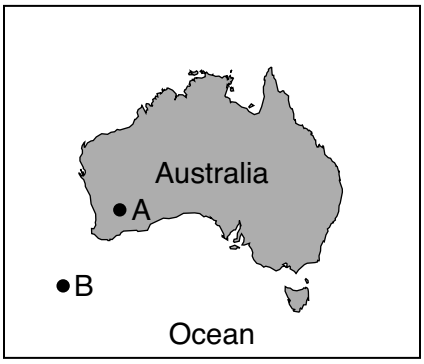
23 A cross section of Earth's crust is represented below. Index fossils are present in some of the rock layers.



These rock layers indicate evidence of past crustal movement based on the principle of

(1) down-warping
(2) crosscutting
(3) original horizontality
(4) contact metamorphism

24 The map below shows the continent of Australia. Letters *A* and *B* indicate locations on Earth's crustal surface.



Compared to the crust at *A*, the crust at *B* is

(1) thinner and less dense
(2) thinner and more dense
(3) thicker and less dense
(4) thicker and more dense

25 Why are *P*-waves received, but *S*-waves are *not* received by seismic stations located on the opposite side of Earth from an earthquake epicenter?

(1) *S*-waves travel slower than *P*-waves.
(2) *S*-waves travel faster than *P*-waves.
(3) Earth's inner core absorbs *S*-waves.
(4) Earth's outer core absorbs *S*-waves.

26 The Tug Hill region of New York State is geologically classified as a plateau because this region has relatively

(1) high elevation and deformed bedrock
(2) low elevation and deformed bedrock
(3) high elevation and horizontal bedrock
(4) low elevation and horizontal bedrock

27 What is the approximate minimum stream velocity required to transport the smallest particles of sand?

(1) 1.0 cm/s
(2) 0.7 cm/s
(3) 0.3 cm/s
(4) 0.1 cm/s

28 Which agent of erosion is primarily responsible for the formation of the barrier islands along the south shoreline of Long Island, New York?

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

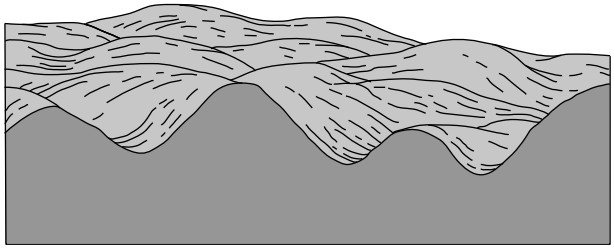
29 A glacial moraine is best described as

(1) unsorted sediment directly deposited by a glacier
(2) sorted sediment deposited as the glacier melts
(3) a body of water formed by a retreating glacier
(4) an elongated hill composed of sand and formed by a retreating glacier

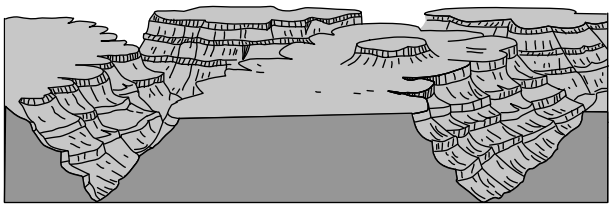
30 Which medium-grain-sized metamorphic rock is composed mostly of the same mineral as the sedimentary rock limestone?

(1) gneiss
(2) marble
(3) quartzite
(4) schist

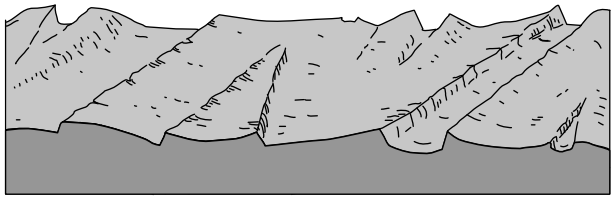
31 Which diagram below best represents the surface features developed in a humid climate?



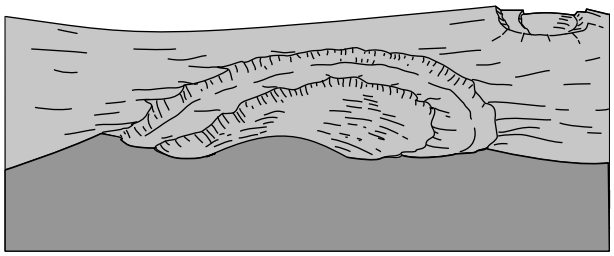
(1)



(3)

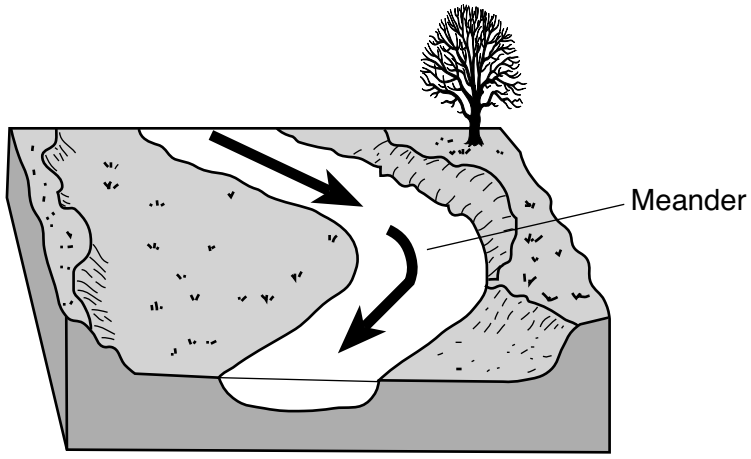


(2)



(4)

32 The block diagram below represents a section of a meandering stream. The arrows show the direction of stream flow.



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

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

33 What is the texture of an igneous rock formed from magma that cooled slowly deep underground?

(1) nonvesicular and coarse
(2) nonvesicular and glassy
(3) vesicular and fine
(4) vesicular and very coarse

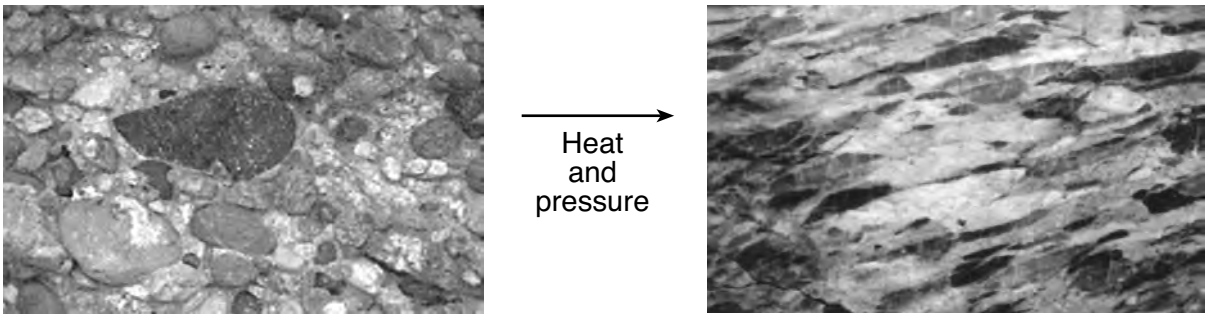
34 The photograph below shows a portion of a roadway in the mountains that was destroyed due to a landslide.

http://fijisun.com.fj

Which two factors most likely caused this landslide?

(1) wind action and meandering streams
(2) wind action and movement of glacial ice
(3) gravity and sand blasting of bedrock
(4) gravity and saturated soil

35 The two photographs below and the arrow between them show conglomerate and the processes that changed the conglomerate to rock *X*.



Conglomerate

Rock X

Rock *X* is most likely

(1) breccia
(2) slate
(3) metaconglomerate
(4) vesicular basalt

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 passage and mineral table below and on your knowledge of Earth science. The table shows some properties of four minerals that display fluorescence.

Fluorescent Minerals

All minerals have the ability to reflect visible light. Only about 15% of minerals have an interesting physical property known as fluorescence. These minerals have the ability to temporarily absorb a small amount of electromagnetic energy and, an instant later, release a small amount of energy of a different wavelength. This change in wavelength causes a temporary color change of the mineral in the eye of an observer. The color change of fluorescent minerals is most spectacular when the minerals are placed in darkness and exposed to electromagnetic energy shorter than visible light.

A former zinc mine in New Jersey is one of the most famous sources of fluorescent minerals in the entire world. Zincite and willemite were two of the zinc ores mined there. It was later discovered that more than 91 minerals in this region displayed fluorescence under shortwave electromagnetic energy.

Mineral	Hardness	Color Under Visible Light	"Fluorescent" Color	Composition
Calcite	3	clear-white-variable	bright orange	$CaCO_3$
Celestine	3 to 3.5	colorless-variable	yellow and/or white/blue	$SrSO_4$
Willemite	5.5	pink-tan	bright green	Zn_2SiO_4
Zincite	4	yellow-orange	yellow	ZnO

36 Which two forms of electromagnetic energy are used to produce the most spectacular fluorescence when placed in darkness?

(1) microwaves and x rays
(2) microwaves and infrared
(3) ultraviolet and x rays
(4) ultraviolet and infrared

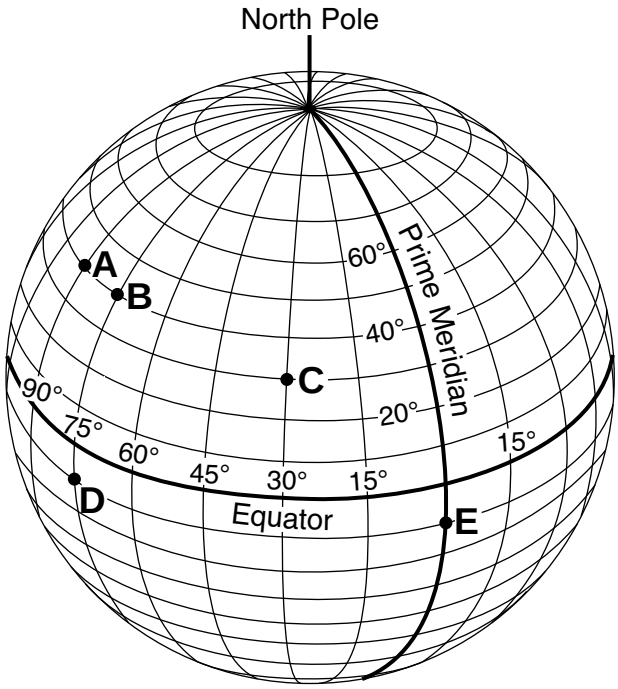
37 Which two minerals can have the same fluorescent color?

(1) calcite and celestine
(2) calcite and zincite
(3) celestine and willemite
(4) celestine and zincite

38 The mineral zincite will scratch

(1) calcite, but will not scratch celestine and willemite
(2) willemite, but will not scratch calcite and celestine
(3) calcite and celestine, but will not scratch willemite
(4) willemite and celestine, but will not scratch calcite

Base your answers to questions 39 and 40 on the diagram below and on your knowledge of Earth science. The diagram represents the lines of latitude and longitude on Earth. Points *A* through *E* represent locations on Earth.



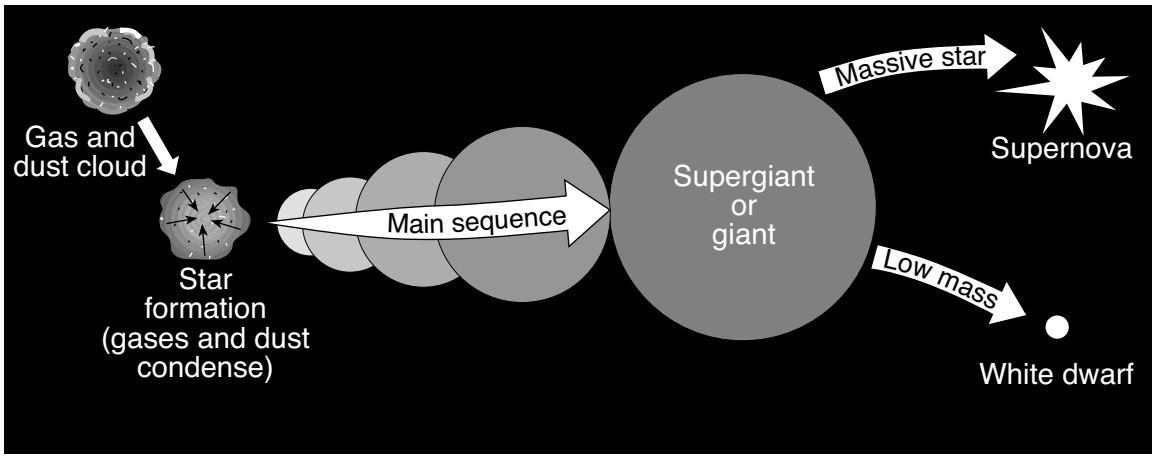
39 Which two locations have the same solar time?

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

40 From which location would an observer *never* see *Polaris* in the nighttime sky?

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

Base your answers to questions 41 through 43 on the diagram below and on your knowledge of Earth science. The diagram represents the inferred origin and evolution of most stars.



41 What causes the gas and dust cloud to condense and become a star?

(1) density
(2) friction
(3) gravity
(4) outgassing

42 Which star is most likely to become a supernova?

(1) Sun
(2) *Deneb*
(3) *Pollux*
(4) *Barnard's Star*

43 Which process produces large amounts of energy in a star by combining lighter elements into a heavier element?

(1) convection
(2) radiation
(3) radioactive decay
(4) nuclear fusion

Base your answers to questions 44 and 45 on the table below and on your knowledge of Earth science. The table shows the disintegration products and half-lives of five commonly used radioactive isotopes.

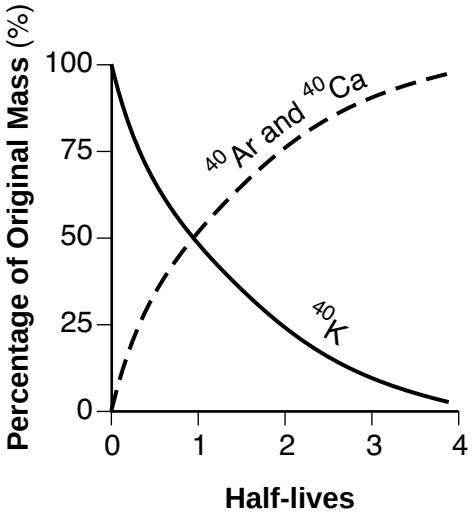
Radioactive Decay Data

Radioactive Isotope	Disintegration	Half-Life (years)
Carbon-14	$^{14}C \longrightarrow {}^{14}N$	5.7×10^3
Potassium-40	$^{40}K \rightarrow {}^{40}Ar$, $^{40}K \rightarrow {}^{40}Ca$	1.3×10^9
Uranium-235	$^{235}U \longrightarrow {}^{207}Pb$	7.1×10^8
Uranium-238	$^{238}U \longrightarrow {}^{206}Pb$	4.5×10^9
Rubidium-87	$^{87}Rb \longrightarrow {}^{87}Sr$	4.9×10^{10}

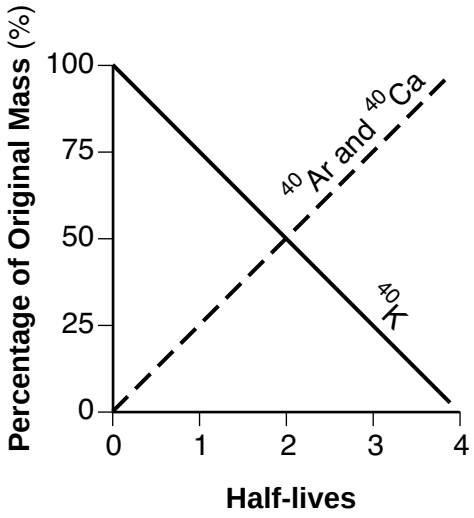
44 Which radioactive isotope takes the greatest amount of time to disintegrate?

(1) potassium-40
(2) uranium-235
(3) uranium-238
(4) rubidium-87

45 Which graph below represents the amount of potassium-40 and the amount of argon-40 and calcium-40 over four half-lives?



(1)



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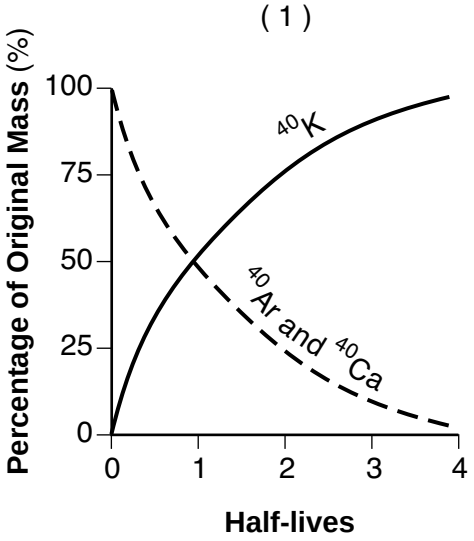
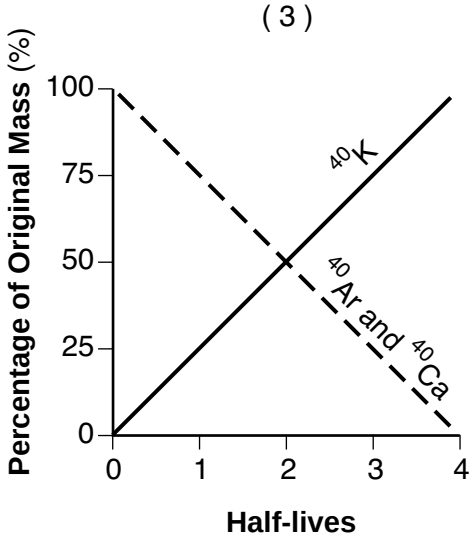
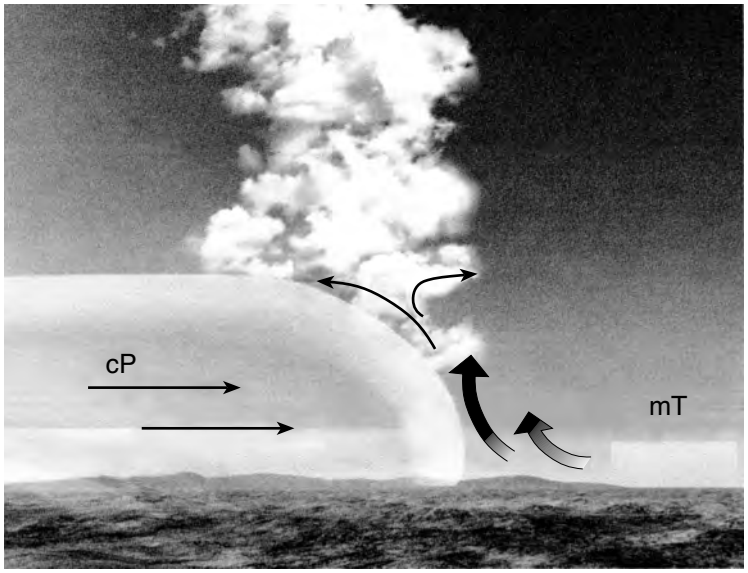


(2)



(4)

Base your answers to questions 46 through 48 on the cross section below and on your knowledge of Earth science. The arrows on the cross section represent the air movement along a weather front between two different air masses. The air masses are labeled.



46 Which type of front is represented by this cross section?

(1) warm
(2) cold
(3) stationary
(4) occluded

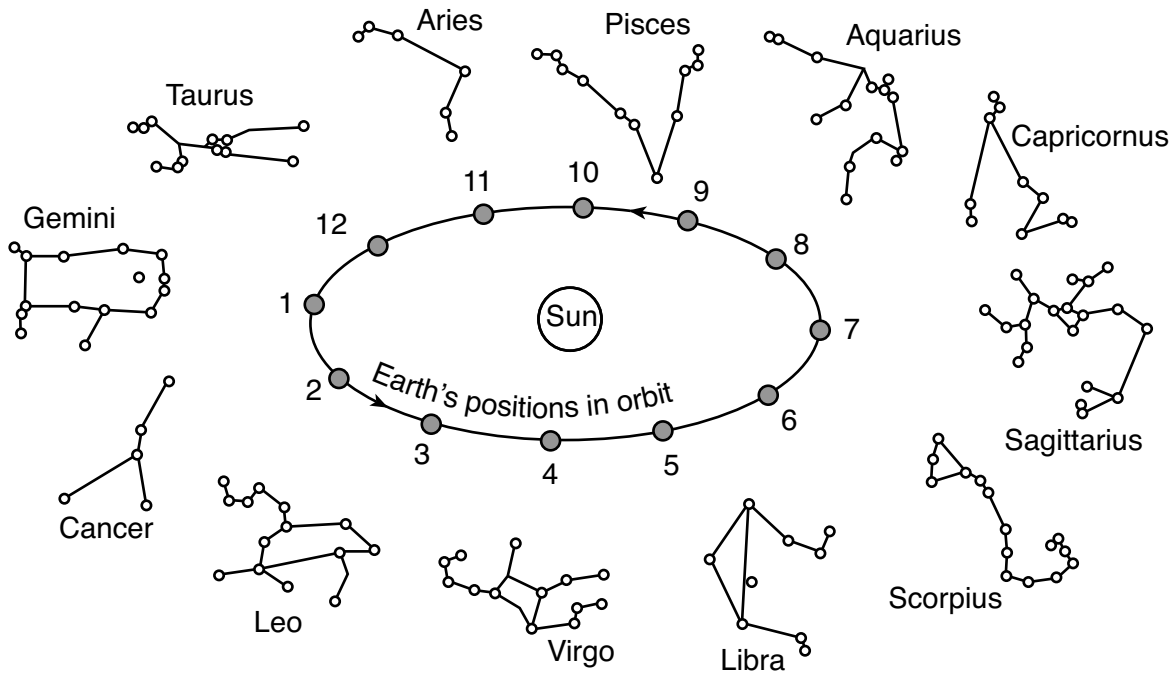
47 Clouds are forming along the front because the rising air is

(1) contracting and warming, causing evaporation
(2) contracting and cooling, causing evaporation
(3) expanding and warming, causing condensation
(4) expanding and cooling, causing condensation

48 Which statement best describes the difference in air temperature and humidity between the cP and mT air masses?

(1) The mT air mass is warmer and more humid.
(2) The mT air mass is cooler and less humid.
(3) The cP air mass is warmer and less humid.
(4) The cP air mass is cooler and more humid.

Base your answers to questions 49 and 50 on the diagram below and on your knowledge of Earth science. The diagram represents twelve positions of Earth in its orbit around the Sun and twelve constellations that can be seen in the midnight sky by an observer looking south in New York State at different times of the year. The approximate locations of the constellations in relation to Earth's orbit are shown.



(Not drawn to scale)

49 Which motion causes observers on Earth to see different constellations at different times of the year?

(1) Earth revolves around the constellations.
(2) Earth revolves around the Sun.
(3) The constellations revolve around Earth.
(4) The constellations revolve around the Sun.

50 At position 5, an observer on Earth sees a full Moon (the fully lighted side of the Moon) at midnight. At this time, the full Moon would appear closest to the constellation

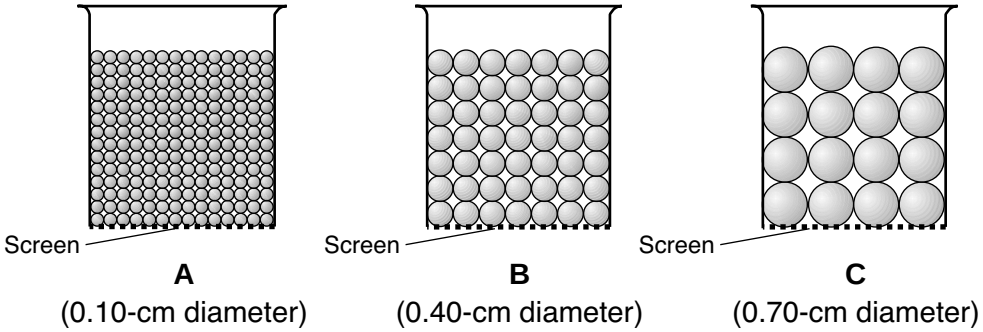
(1) Aries
(2) Capricornus
(3) Libra
(4) Scorpius

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 below and on your knowledge of Earth science. The diagram represents three containers, *A*, *B*, and *C*, which have the same volume and are filled to the same level with uniform-sized beads. The beads are held in place by a screen across the bottom of each container.



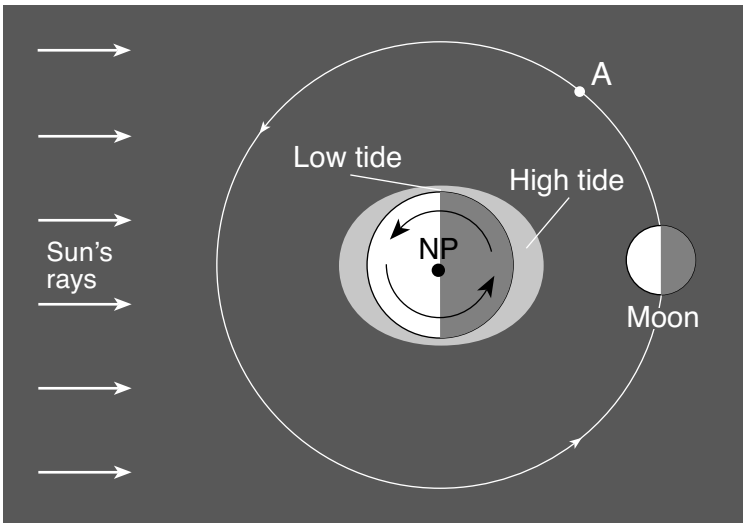
(Not drawn to scale)

51 Draw a line on grid 1 *in your answer booklet* to show the general relationship between bead size and capillarity. Draw a line on grid 2 *in your answer booklet* to show the general relationship between bead size and permeability. [1]

52 Describe one way to prepare a fourth container of beads, filled to the same level as shown in *A*, *B*, and *C*, that would reduce porosity. [1]

Base your answers to questions 53 and 54 on the ocean tide diagram below and on your knowledge of Earth science. The diagram represents a north pole (NP) view of Earth and the Moon's orbital position during a spring tide. Spring tides occur when the Sun, Earth, and Moon are aligned, producing high tides that are extremely high and low tides that are extremely low. Point *A* indicates another position of the Moon in its orbit.

Spring Tide



(Not drawn to scale)

53 On the diagram *in your answer booklet*, place an **X** on the Moon's orbit to indicate the Moon's position when the next spring tide will occur. [1]

54 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 located at position *A*. [1]

Base your answers to questions 55 through 57 on the map *in your answer booklet* and on your knowledge of Earth science. The map shows a portion of the continent of North America and some of the major rivers. The Rio Grande and the Mississippi River are labeled. Points *A* and *B* represent locations along the Mississippi River. Point *C* represents a location along a river in New York State (NY) that is part of the Mississippi River watershed.

55 On the map *in your answer booklet*, place an **X** on the tributary that is located farthest south and flows into the Mississippi River. [1]

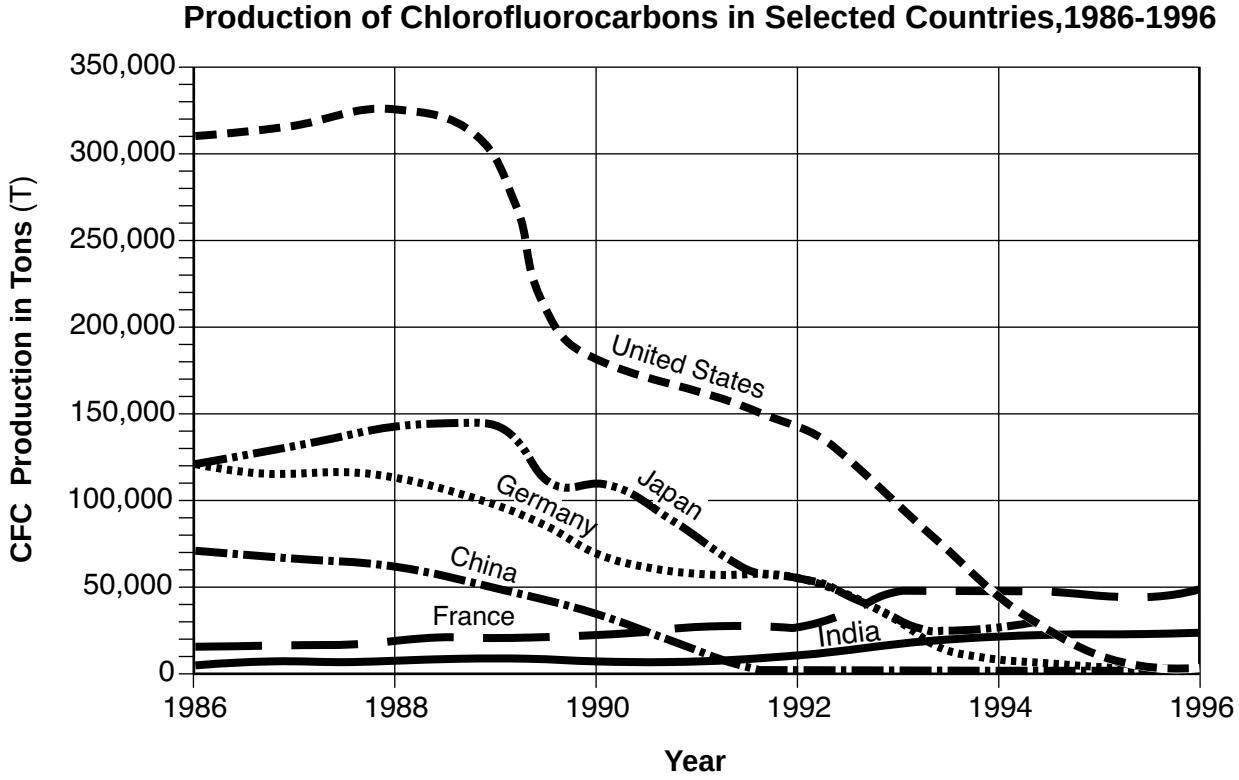
56 Describe the change in shape and change in size of sediments as they are transported in the Mississippi River from point *A* to point *B*. [1]

57 Identify the name of the New York State landscape region where the river at point *C* is located. [1]

Base your answers to questions 58 through 61 on the passage and graph below and on your knowledge of Earth science. The graph shows changes in the amount of chlorofluorocarbon production, in tons per year (T/y), by some countries over a 10-year period.

CFCs and Ozone

CFCs (chlorofluorocarbons) are chemicals that threaten to destroy stratospheric ozone. CFCs were first manufactured in 1928 to be used as chilling agents in refrigerators. In later years, they were used for cleaning electrical circuit boards and to make foam for insulation. Unfortunately, scientists found that these chemicals escaped into the atmosphere and rose to the stratosphere. In the stratosphere, intense ultraviolet (UV) radiation broke the CFCs down, producing chlorine, a gas that reacts with and destroys ozone. In 1974, two scientists identified the depletion of stratospheric ozone from the release of CFCs. After this discovery, 27 countries agreed to reduce production of CFCs, because ozone in the stratosphere protects all life from the Sun's most damaging UV rays.



Adapted from: Gore, Al. *An Inconvenient Truth*

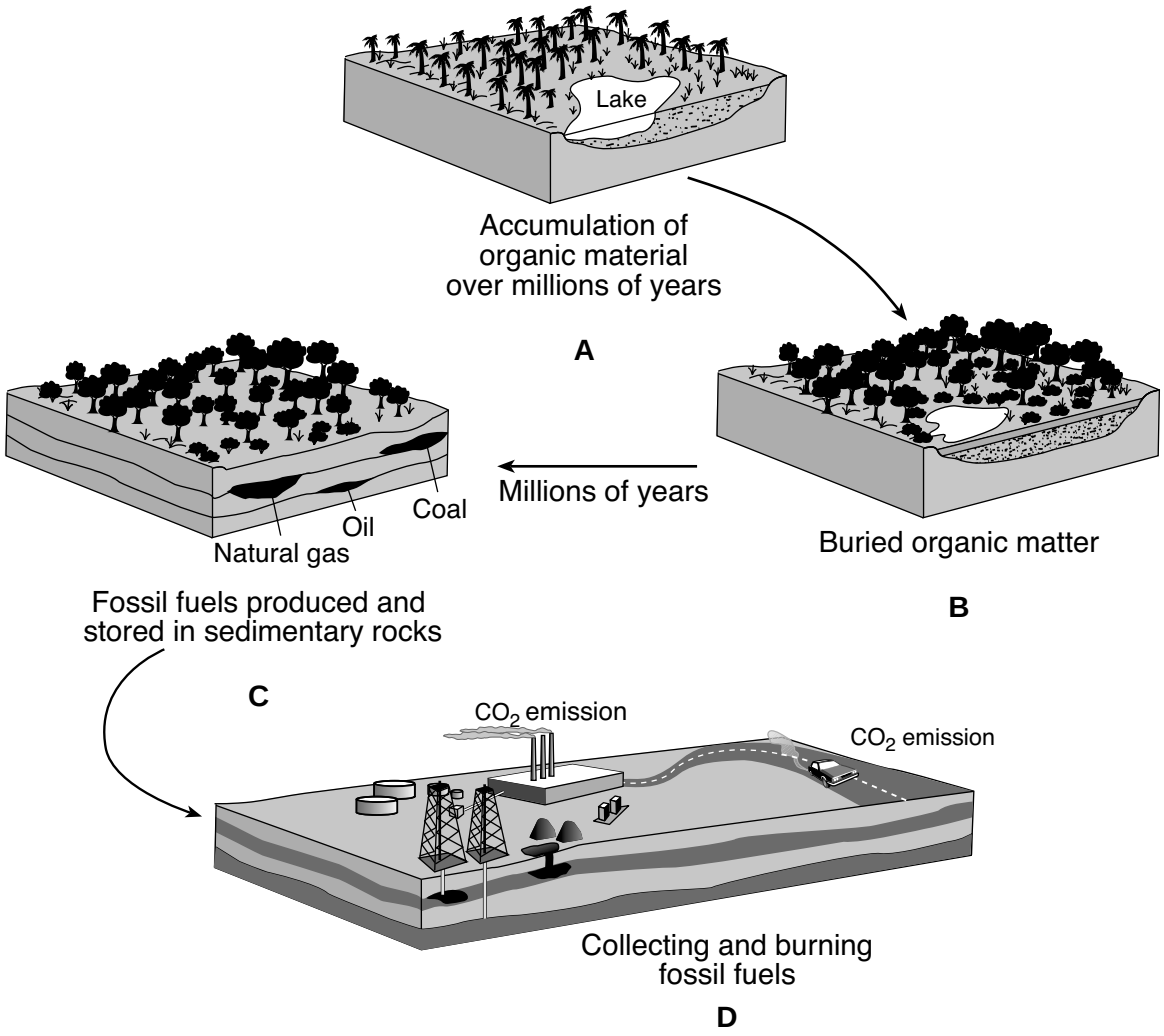
58 Write the chemical symbol for the element produced by the breakdown of CFCs. Describe *one* environmental impact that results from this element being released into Earth's stratosphere. [1]

59 Identify the name of the atmospheric temperature zones directly below and directly above the atmospheric layer in which intense UV radiation breaks down CFCs. [1]

60 Calculate the approximate rate, in tons per year (T/y), at which the United States *decreased* CFC production in the 8 years between 1988 and 1996. [1]

61 Based on the graph, identify the *two* countries that began to decrease CFC production as early as 1986. [1]

Base your answers to questions 62 through 65 on the diagram below and on your knowledge of Earth science. The diagram represents the formation of coal and other fossil fuels in the environment.



Adapted from: Wright, Richard and Nebel, Bernard. *Environmental Science, Learning System Edition*

62 Identify the geologic time period in which the extensive coal-forming forests represented in diagram *A* were most abundant. [1]

63 Identify *one* process that changed the buried organic matter of diagram *B* into coal. [1]

64 Identify the primary chemical element found in coal. [1]

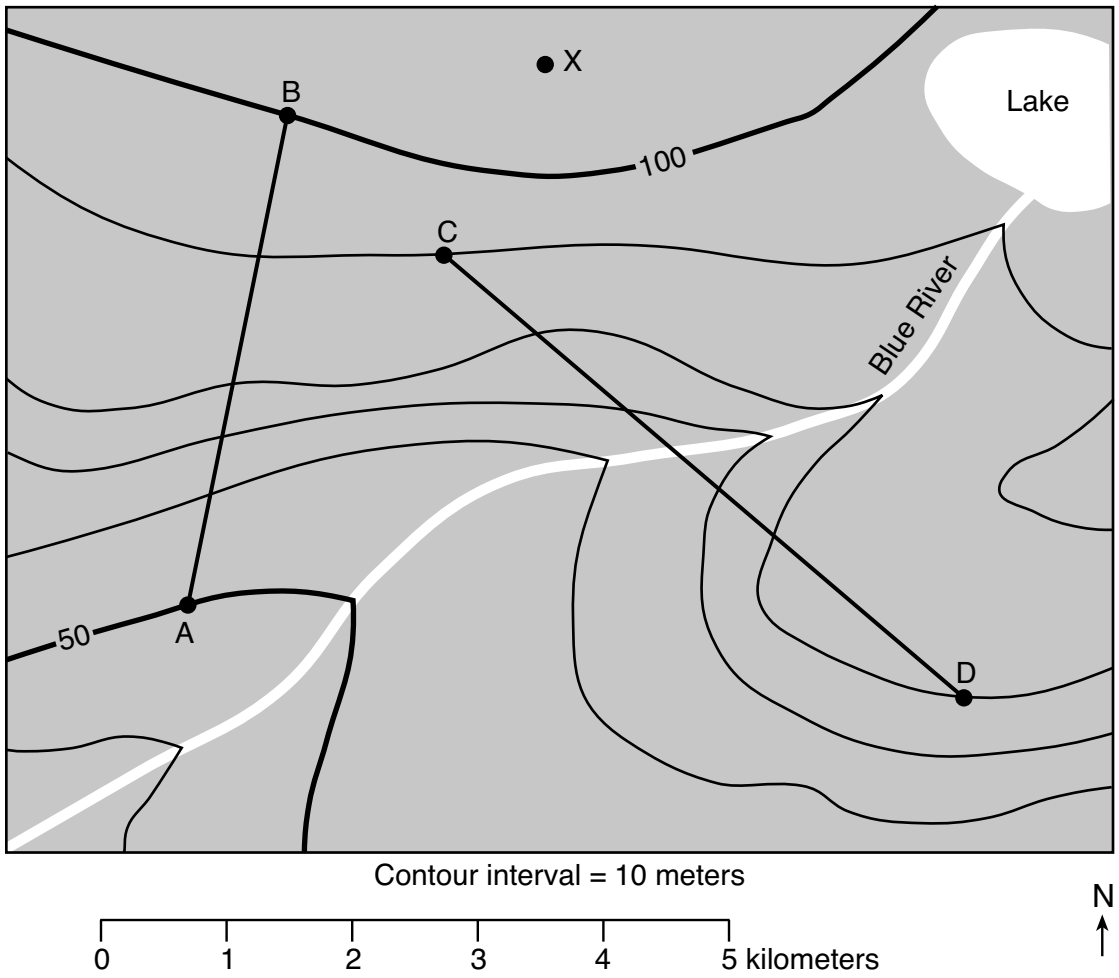
65 The burning of fossil fuels, represented in *D*, produces the greenhouse gas carbon dioxide (CO_2), which is associated with air pollution and global warming. Other than CO_2, identify *one* other major greenhouse gas. [1]

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 topographic map below and on your knowledge of Earth science. Points *A*, *B*, *C*, *D*, and *X* represent surface locations on the map. Lines *AB* and *CD* are reference lines.

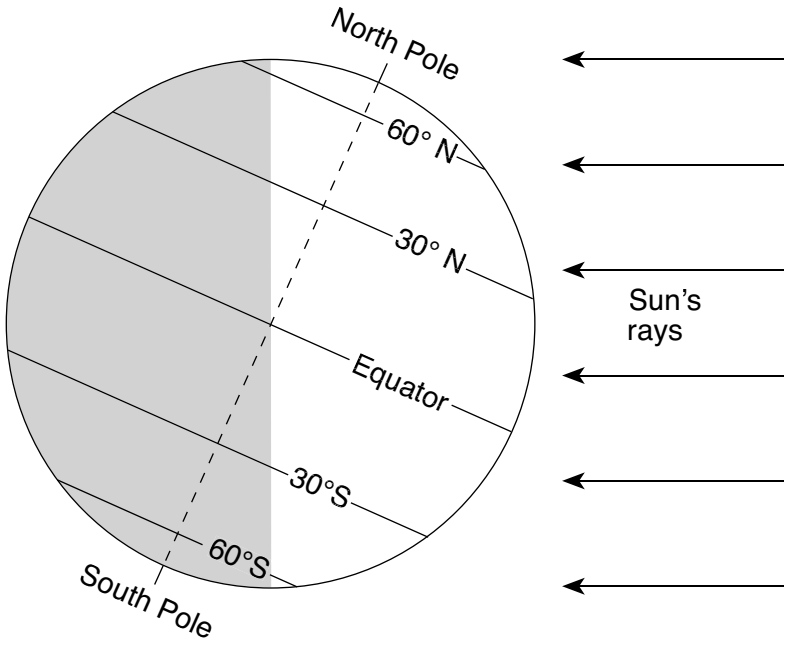


66 Calculate the gradient along the reference line from *A* to *B*. Include units with your answer. [1]

67 On the grid *in your answer booklet*, construct a topographic profile along line *CD* by plotting the elevation of each contour line that crosses line *CD*. Connect *all six* plots with a line to complete the profile. [1]

68 Determine *one* possible elevation of point *X*. [1]

Base your answers to questions 69 through 71 on the diagram below and on your knowledge of Earth science. The diagram represents a side view of Earth. The North Pole and some latitudes are labeled. The dashed line represents Earth's axis.



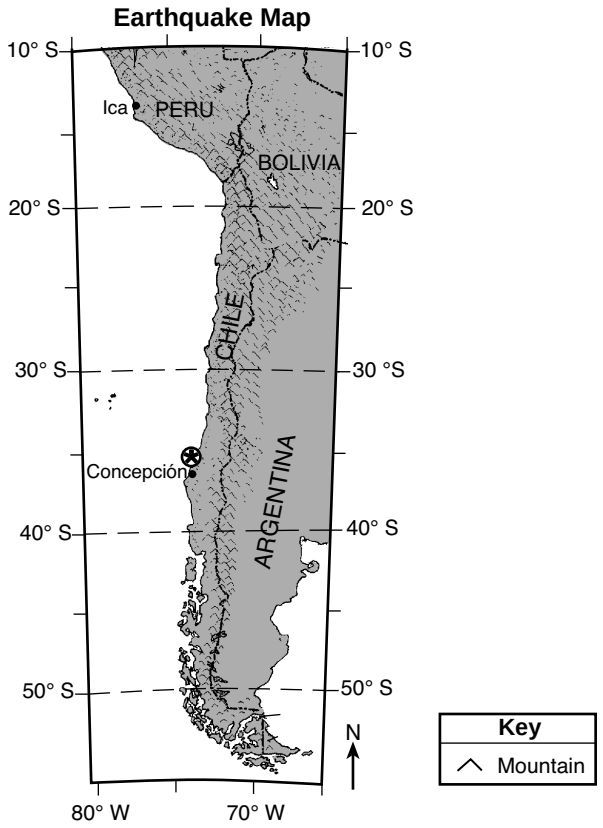
69 Identify the season that is just beginning in the Northern Hemisphere when Earth is in this position. [1]

70 State the number of hours of daylight that would be experienced at the Equator three months after the date represented by this diagram. [1]

71 State the general relationship between latitude and the duration of insolation on this day from the Equator to 60° N. [1]

Base your answers to questions 72 through 75 on the passage and map below and on your knowledge of Earth science. The map shows the location of a major earthquake that occurred in 2010 off the west coast of Chile, in South America. The star ⊛ represents the location of the earthquake epicenter.

On February 27, 2010, a strong earthquake with a magnitude of 8.8 occurred off the west coast of South America near the city of Concepción in central Chile. There was tremendous damage to the region and loss of life, as buildings collapsed. Tremors were felt as far north as Ica, Peru, 2400 kilometers away. The earthquake triggered a tsunami that damaged several coastal towns. Tsunami warnings were issued to 53 countries, including the United States, where damage was reported. This earthquake is ranked as one of the highest in magnitude ever recorded by a seismograph. Chile has experienced some of the strongest earthquakes in the past, including a 1960 earthquake that had a magnitude of 9.5, the highest ever recorded.



72 On the block diagram of the tectonic plate boundary *in your answer booklet*, draw *two* arrows, one in each box, to indicate the general direction that each plate moved in relation to each other, causing the 2010 Chile earthquake to occur. [1]

73 Identify the name of the oceanic tectonic plate located along the west coast of South America where this earthquake occurred. [1]

74 Determine the *P*-wave travel time, in minutes and seconds, from this earthquake's epicenter to the tremors that were felt in Ica, Peru. [1]

75 Describe *one* action that coastal residents should have taken in response to the tsunami warnings that would have reduced loss of life. [1]

Base your answers to questions 76 through 78 on the data table below, on the map in your answer booklet, and on your knowledge of Earth science. The table lists storm data for Hurricane Matthew, which occurred in the fall of 2016. Air pressure, wind speed, and storm location are shown for the hurricane's center at the same time each day. The map shows the location of Hurricane Matthew from September 28 to October 4.

Hurricane Matthew Data

Date	Air Pressure (mb)	Wind Speed (mph)	Location of Storm Center
Sept. 28	1008	60	13° N, 61° W
Sept. 29	995	70	14° N, 66° W
Sept. 30	968	115	14° N, 71° W
Oct. 1	946	145	13° N, 74° W
Oct. 2	946	140	14° N, 75° W
Oct. 3	941	140	16° N, 75° W
Oct. 4	949	145	19° N, 74° W
Oct. 5	962	120	22° N, 75° W
Oct. 6	940	140	25° N, 78° W
Oct. 7	946	120	29° N, 81° W
Oct. 8	967	75	33° N, 79° W
Oct. 9	984	75	35° N, 74° W

76 On the map *in your answer booklet*, complete the path of Hurricane Matthew by plotting the location of the storm center for October 5 through October 9. Draw a line to connect *all five* of these plots to the October 4 plot to complete the path. [1]

77 Identify the *two* consecutive dates between which the greatest *decrease* in air pressure occurred. [1]

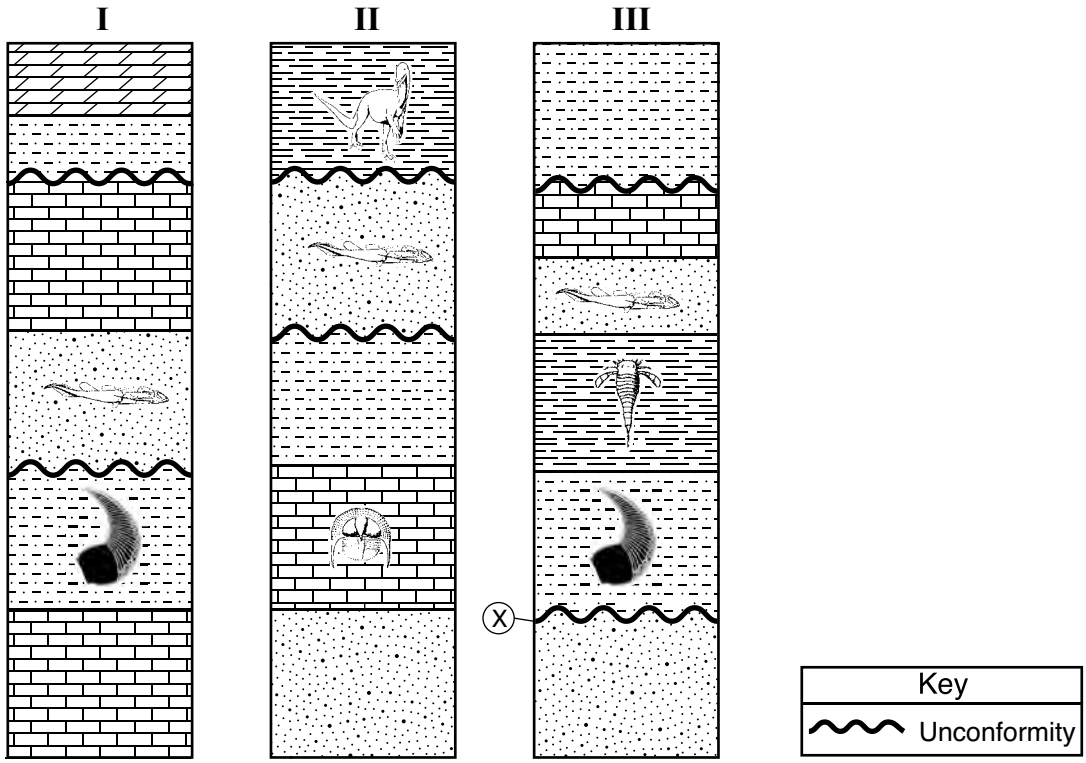
78 The table below shows the Saffir-Simpson Scale, which is used to classify hurricanes.

Saffir-Simpson Scale

Classification of Hurricane	Wind Speed (mph)
Category 1	74-95
Category 2	96-110
Category 3	111-129
Category 4	130-156
Category 5	≥157

Identify the greatest wind speed of Hurricane Matthew listed on the data table, and identify the classification of Hurricane Matthew based on this wind speed. [1]

Base your answers to questions 79 through 81 on the diagrams below and on your knowledge of Earth science. The diagrams represent three sedimentary rock outcrops labeled I, II, and III, found in the northeastern United States. The outcrops have *not* been overturned. Some rock layers contain New York State index fossils. One unconformity has been labeled *X*.



79 Identify the names of the *two* index fossils found in these rock layers that represent organisms that could have been alive at the same time. [1]

80 Good index fossils are often abundant or easily identified. Describe *one* other characteristic of these fossils that makes them index fossils. [1]

81 Identify, by name, the sedimentary rock layer that is missing from rock outcrop III due to the formation of unconformity *X*. [1]

Base your answers to questions 82 through 85 on the information and data table below and on your knowledge of Earth science. The table shows data for the six planets in the *Kepler-11* star system.

Kepler-11 is one of many star systems discovered by space satellites. Scientists find this system unusual because of its small size and its six planets, identified by letters *b* through *g*, that orbit relatively close to its central star. The central star, *Kepler-11*, has a surface temperature of 5663 K and a luminosity of 1.0.

Planet	**Mean Distance from Star** (million km)	**Period of Revolution** (days)	**Eccentricity of Orbit**	**Equatorial Diameter** (km)	**Density** (g/cm^3)
Kepler-11b	13.7	10.3	0.045	45,869	1.70
Kepler-11c	16.0	13.0	0.026	73,151	0.66
Kepler-11d	23.2	22.7	0.004	79,528	1.28
Kepler-11e	29.1	32.0	0.012	106,780	0.58
Kepler-11f	37.5	46.7	0.013	63,456	0.69
Kepler-11g	69.7	118.4	0.150	84,847	1.20

82 Describe the relationship between a planet's mean distance from this star and the period of revolution. [1]

83 The diagram *in your answer booklet* represents the scaled distances of Mercury, Venus, and Earth from the Sun. Place an **X** on the line to indicate where *Kepler-11c* would be located if it were in our solar system. [1]

84 Identify the *two* planets in our solar system that have an orbital shape most similar to the orbital shape of *Kepler-11b*. [1]

85 Identify the star located on the *Characteristics of Stars* graph on the *Physical Setting/Earth Science Reference Tables* that has the most similar surface temperature and luminosity as the *Kepler-11 star*. [1]

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P.S./EARTH SCIENCE

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Friday, January 24, 2020 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

Student . . . . . .

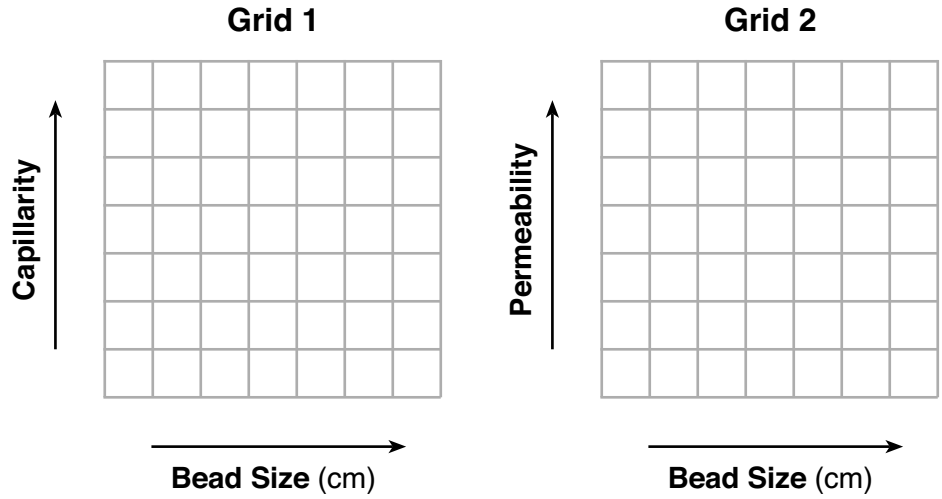
Teacher . . . . . .

School . . . . . Grade . . . . . .

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

Part B–2

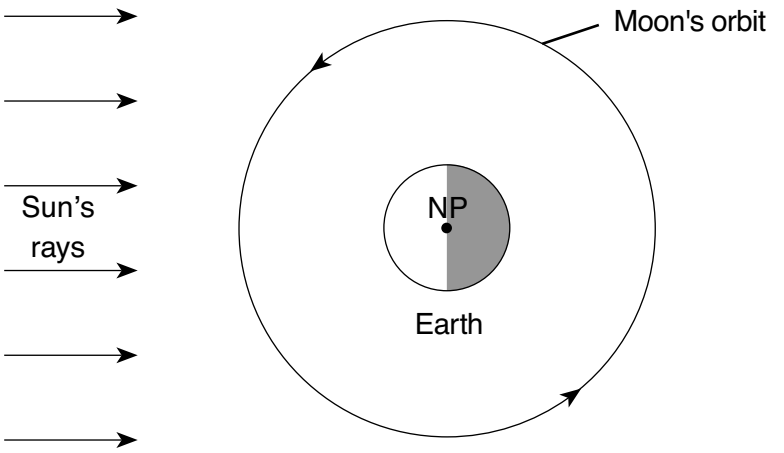
51



52 _____

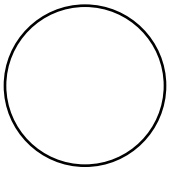
_____

53

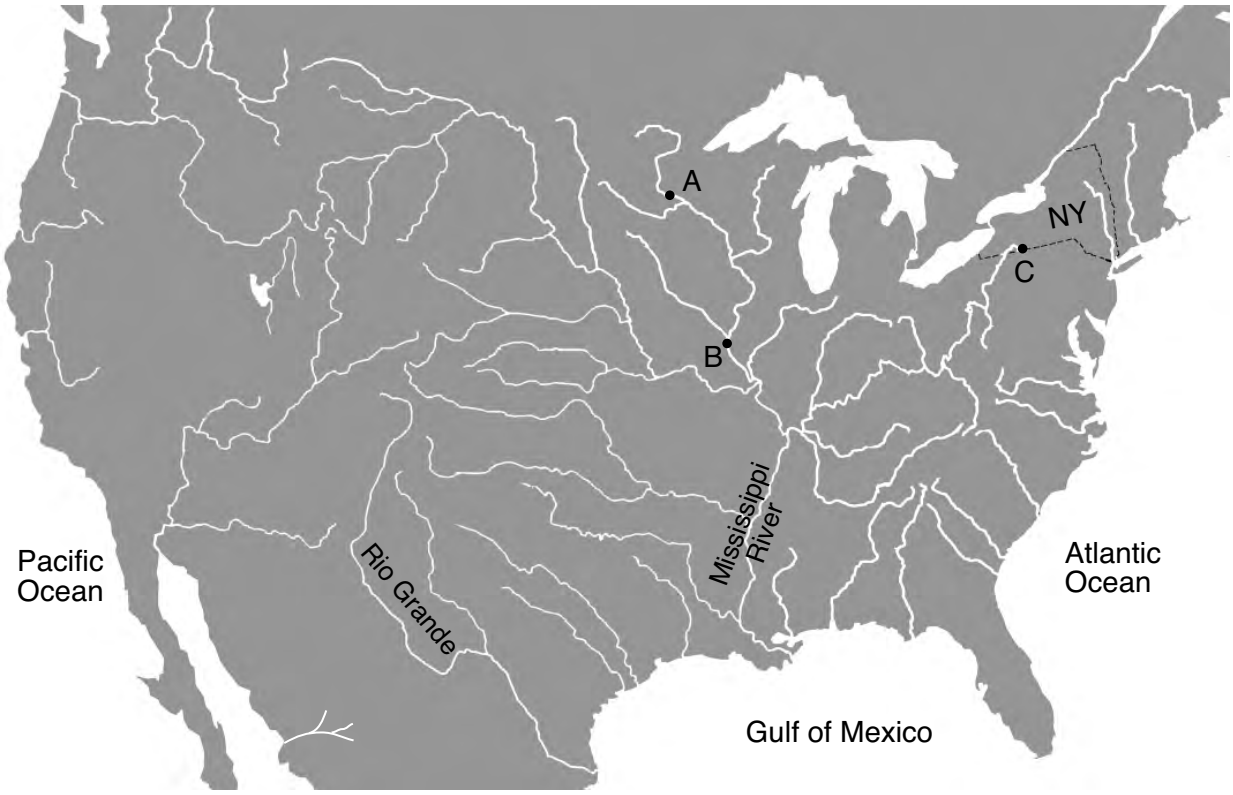


(Not drawn to scale)

54



55



56 Change in shape: _____

Change in size: _____

57 _____

58 Chemical symbol: _____

Environmental impact: _____

_____

59 _____ and _____

60 _____ **T/y**

61 _____ and _____

62 _____ **Period**

63 _____

64 _____

65 _____

Part C

66 _____

67

68 _____ **m**

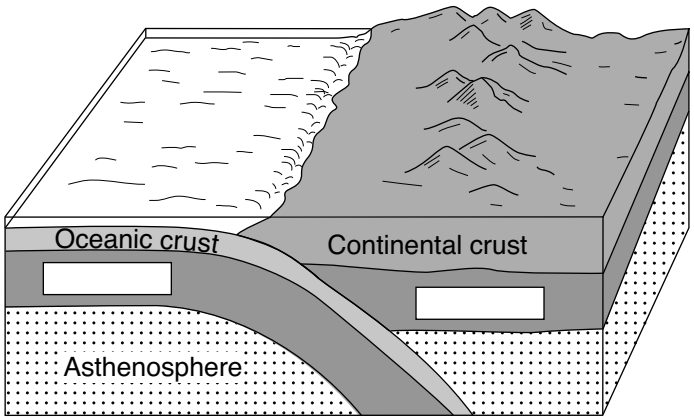
69 _____

70 _____ **h**

71 _____

_____

72



(Not drawn to scale)

73 _____ **Plate**

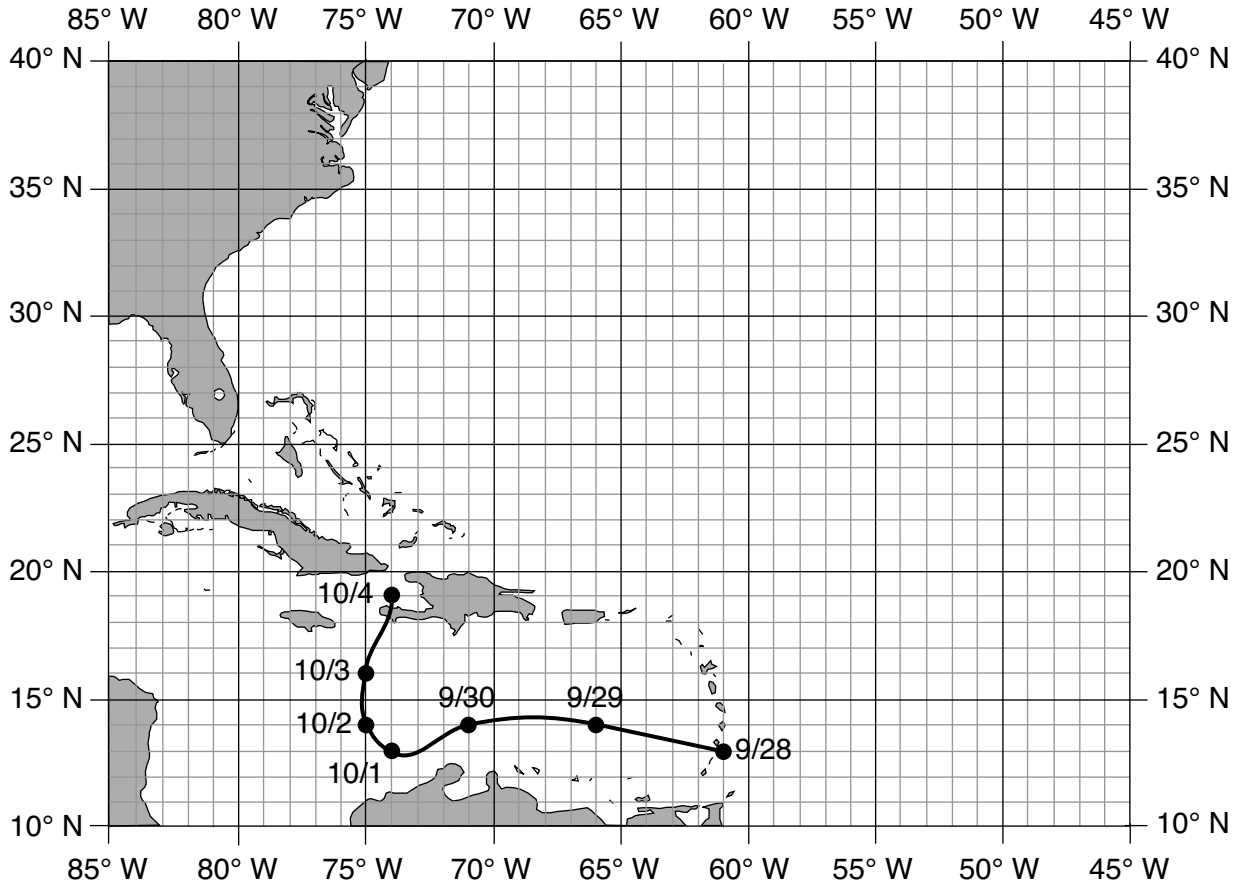
74 _____ **min** _____ **s**

75 _____

_____

76

Hurricane Tracking Map
Hurricane Matthew, Fall 2016



77 From _____ to _____

78 Wind speed: _____ **mph**

Classification of hurricane: _____

79 _____ and _____

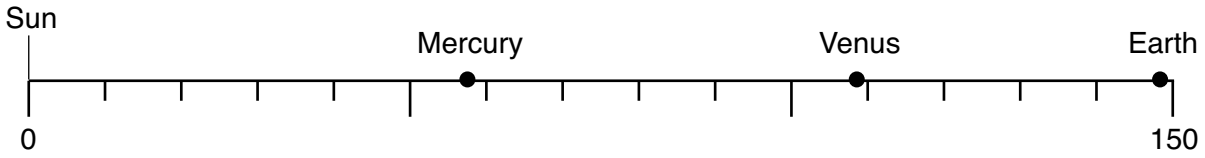
80 _____

81 _____

82 _____

_____

83



(Distances drawn to scale in million kilometers)

84 _____ and _____

85 _____

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The State Education Department / The University of the State of New York

Regents Examination in Physical Setting/Earth Science – January 2020

Scoring Key: Parts A and B-1 (Multiple-Choice Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Physical Setting/Earth Science	January '20	**1**	1	MC	1	1
Physical Setting/Earth Science	January '20	**2**	1	MC	1	1
Physical Setting/Earth Science	January '20	**3**	2	MC	1	1
Physical Setting/Earth Science	January '20	**4**	4	MC	1	1
Physical Setting/Earth Science	January '20	**5**	1	MC	1	1
Physical Setting/Earth Science	January '20	**6**	2	MC	1	1
Physical Setting/Earth Science	January '20	**7**	2	MC	1	1
Physical Setting/Earth Science	January '20	**8**	3	MC	1	1
Physical Setting/Earth Science	January '20	**9**	1	MC	1	1
Physical Setting/Earth Science	January '20	**10**	2	MC	1	1
Physical Setting/Earth Science	January '20	**11**	4	MC	1	1
Physical Setting/Earth Science	January '20	**12**	4	MC	1	1
Physical Setting/Earth Science	January '20	**13**	1	MC	1	1
Physical Setting/Earth Science	January '20	**14**	2	MC	1	1
Physical Setting/Earth Science	January '20	**15**	4	MC	1	1
Physical Setting/Earth Science	January '20	**16**	4	MC	1	1
Physical Setting/Earth Science	January '20	**17**	3	MC	1	1
Physical Setting/Earth Science	January '20	**18**	1	MC	1	1
Physical Setting/Earth Science	January '20	**19**	3	MC	1	1
Physical Setting/Earth Science	January '20	**20**	1	MC	1	1
Physical Setting/Earth Science	January '20	**21**	3	MC	1	1
Physical Setting/Earth Science	January '20	**22**	2	MC	1	1
Physical Setting/Earth Science	January '20	**23**	3	MC	1	1
Physical Setting/Earth Science	January '20	**24**	2	MC	1	1
Physical Setting/Earth Science	January '20	**25**	4	MC	1	1
Physical Setting/Earth Science	January '20	**26**	3	MC	1	1
Physical Setting/Earth Science	January '20	**27**	3	MC	1	1
Physical Setting/Earth Science	January '20	**28**	1	MC	1	1
Physical Setting/Earth Science	January '20	**29**	1	MC	1	1
Physical Setting/Earth Science	January '20	**30**	2	MC	1	1
Physical Setting/Earth Science	January '20	**31**	1	MC	1	1
Physical Setting/Earth Science	January '20	**32**	4	MC	1	1
Physical Setting/Earth Science	January '20	**33**	1	MC	1	1
Physical Setting/Earth Science	January '20	**34**	4	MC	1	1
Physical Setting/Earth Science	January '20	**35**	3	MC	1	1
Physical Setting/Earth Science	January '20	**36**	3	MC	1	1
Physical Setting/Earth Science	January '20	**37**	4	MC	1	1
Physical Setting/Earth Science	January '20	**38**	3	MC	1	1
Physical Setting/Earth Science	January '20	**39**	2	MC	1	1
Physical Setting/Earth Science	January '20	**40**	4	MC	1	1
Physical Setting/Earth Science	January '20	**41**	3	MC	1	1
Physical Setting/Earth Science	January '20	**42**	2	MC	1	1
Physical Setting/Earth Science	January '20	**43**	4	MC	1	1
Physical Setting/Earth Science	January '20	**44**	4	MC	1	1
Physical Setting/Earth Science	January '20	**45**	1	MC	1	1
Physical Setting/Earth Science	January '20	**46**	2	MC	1	1
Physical Setting/Earth Science	January '20	**47**	4	MC	1	1
Physical Setting/Earth Science	January '20	**48**	1	MC	1	1
Physical Setting/Earth Science	January '20	**49**	2	MC	1	1
Physical Setting/Earth Science	January '20	**50**	3	MC	1	1

Regents Examination in Physical Setting/Earth Science – January 2020

Scoring Key: Parts B-2 and C (Constructed-Response Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Physical Setting/Earth Science	January '20	**51**		CR	1	1
Physical Setting/Earth Science	January '20	**52**		CR	1	1
Physical Setting/Earth Science	January '20	**53**		CR	1	1
Physical Setting/Earth Science	January '20	**54**		CR	1	1
Physical Setting/Earth Science	January '20	**55**		CR	1	1
Physical Setting/Earth Science	January '20	**56**		CR	1	1
Physical Setting/Earth Science	January '20	**57**		CR	1	1
Physical Setting/Earth Science	January '20	**58**		CR	1	1
Physical Setting/Earth Science	January '20	**59**		CR	1	1
Physical Setting/Earth Science	January '20	**60**		CR	1	1
Physical Setting/Earth Science	January '20	**61**		CR	1	1
Physical Setting/Earth Science	January '20	**62**		CR	1	1
Physical Setting/Earth Science	January '20	**63**		CR	1	1
Physical Setting/Earth Science	January '20	**64**		CR	1	1
Physical Setting/Earth Science	January '20	**65**		CR	1	1
Physical Setting/Earth Science	January '20	**66**		CR	1	1
Physical Setting/Earth Science	January '20	**67**		CR	1	1
Physical Setting/Earth Science	January '20	**68**		CR	1	1
Physical Setting/Earth Science	January '20	**69**		CR	1	1
Physical Setting/Earth Science	January '20	**70**		CR	1	1
Physical Setting/Earth Science	January '20	**71**		CR	1	1
Physical Setting/Earth Science	January '20	**72**		CR	1	1
Physical Setting/Earth Science	January '20	**73**		CR	1	1
Physical Setting/Earth Science	January '20	**74**		CR	1	1
Physical Setting/Earth Science	January '20	**75**		CR	1	1
Physical Setting/Earth Science	January '20	**76**		CR	1	1
Physical Setting/Earth Science	January '20	**77**		CR	1	1
Physical Setting/Earth Science	January '20	**78**		CR	1	1
Physical Setting/Earth Science	January '20	**79**		CR	1	1
Physical Setting/Earth Science	January '20	**80**		CR	1	1
Physical Setting/Earth Science	January '20	**81**		CR	1	1
Physical Setting/Earth Science	January '20	**82**		CR	1	1
Physical Setting/Earth Science	January '20	**83**		CR	1	1
Physical Setting/Earth Science	January '20	**84**		CR	1	1
Physical Setting/Earth Science	January '20	**85**		CR	1	1

Key
MC = Multiple-choice question
CR = Constructed-response question

The chart for determining students' final examination scores for the **January 2020 Regents Examination in Physical Setting/Earth Science** will be posted on the Department's web site at http://www.p12.nysed.gov/assessment/ on the day of the examination. Conversion charts provided for the previous administrations of the Physical Setting/Earth Science examination must NOT be used to determine students' final scores for this administration.

FOR TEACHERS ONLY

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

PHYSICAL SETTING/EARTH SCIENCE

Friday, January 24, 2020 — 9:15 a.m. to 12:15 p.m., only

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.

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*.

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 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. Do not attempt to correct the student's work by making insertions or changes of any kind. 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 24, 2020. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

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

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

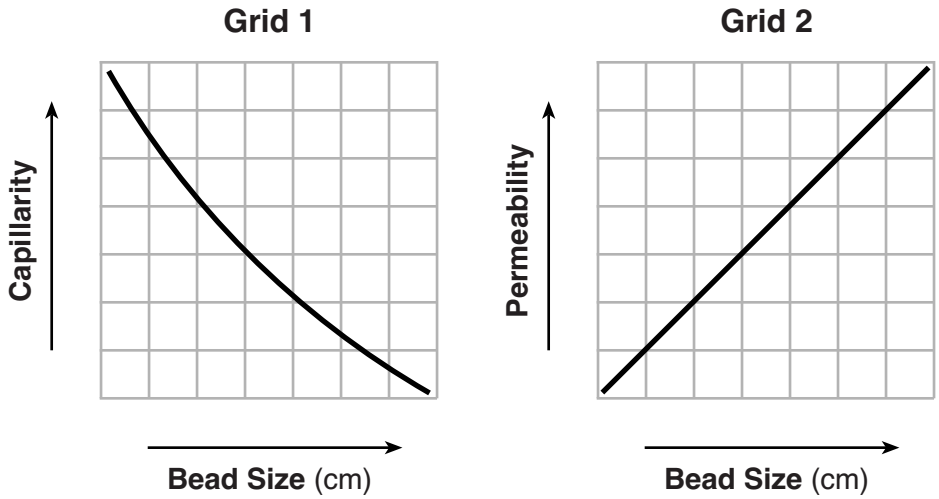
Part B–2

Allow a maximum of 15 credits for this part.

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

51 [1] Allow 1 credit for grid 1 showing an inverse relationship, and grid 2 showing a direct relationship.

Example of a 1-credit response:



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

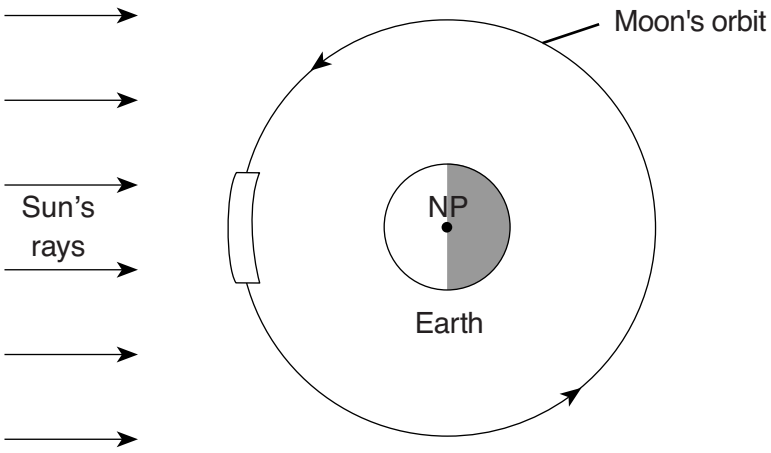
— Mix beads of two or more sizes.

— Use beads of varying shapes.

— Use an unsorted mixture of beads.

— Pack the beads more tightly together.

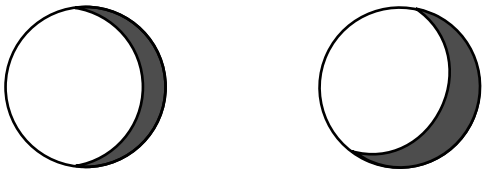
53 [1] Allow 1 credit if the center of the **X** is within or touches the clear region on the Moon's orbit shown below.



(Not drawn to scale)

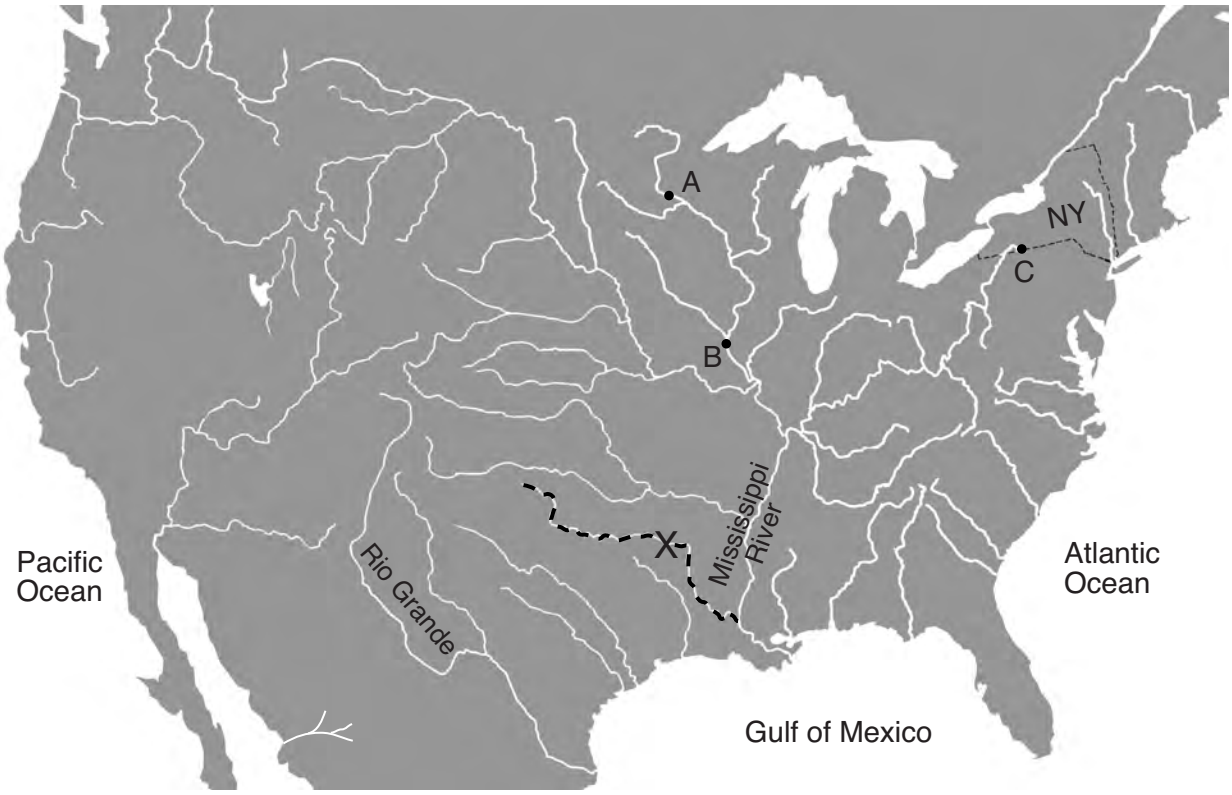
54 [1] Allow 1 credit for shading in less than half of the right side of the Moon.

Examples of a 1-credit response:



55 [1] Allow 1 credit if the center of the **X** is on or touches the dashed line as shown below.

Example of a 1-credit response.



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

Change in shape:

— The sediments become more rounded.

— less angular

Change in size:

— The sediments become smaller.

— Bigger sediments are broken into smaller pieces.

Note: Do *not* allow credit for "smooth" alone for change in shape because smooth is not a shape.

57 [1] Allow 1 credit for Allegheny Plateau *or* Appalachian Plateau (Uplands).

58 [1] Allow 1 credit for the symbol Cl and a correct environmental impact. Acceptable responses include, but are not limited to:

— reacts with and destroys ozone

— Chlorine breaks down ozone molecules.

— increases the amount of UV rays reaching Earth's surface

Note: Do *not* allow credit for "chlorine" for the chemical symbol because this is the name of the element not the chemical symbol.

Do *not* allow credit for "CL" for the chemical symbol because this is not the correct format for writing chemical symbols.

59 [1] Allow 1 credit for troposphere and mesosphere.

60 [1] Allow 1 credit for any value from 38,750 T/y to 41,250 T/y.

Note: Allow credit if the answer is expressed as a negative value.

61 [1] Allow 1 credit for Germany and China.

62 [1] Allow 1 credit for Carboniferous *or* Pennsylvanian Period.

Note: Do *not* allow credit for "Early Pennsylvanian" or "Late Pennsylvanian" because these terms denote epochs not periods.

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

— compaction

— compression

— metamorphism/heat and/or pressure

Note: Do *not* allow credit for "cementation" because coal is formed from compacted plant remains.

64 [1] Allow 1 credit for carbon *or* C.

65 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— CH_4/methane

— H_2O gas/water vapor

— N_2O/nitrous oxide

— O_3/ozone

— CFCs/chlorofluorocarbons

Part C

Allow a maximum of 20 credits for this part.

66 [1] Allow 1 credit for any value from 12.1 to 12.9 and the correct units. Units include, but are not limited to:

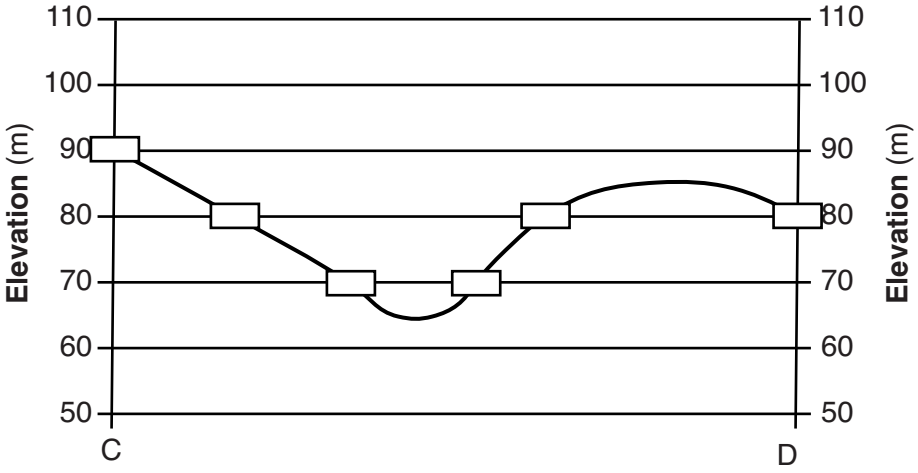
— m/km

— meters per kilometer

67 [1] Allow 1 credit if the centers of *all six* plots are within or touch the rectangles shown below and are correctly connected with a line from *C* to *D* that passes within or touches each rectangle. The line should extend below 70 m but not touch 60 m in the valley. The line should extend above 80 m, but not touch 90 m on the hill.

Note: Allow credit if the 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.



68 [1] Allow 1 credit for any value greater than 100 meters, but less than 110 meters.

69 [1] Allow 1 credit for summer.

70 [1] Allow 1 credit for 12 h.

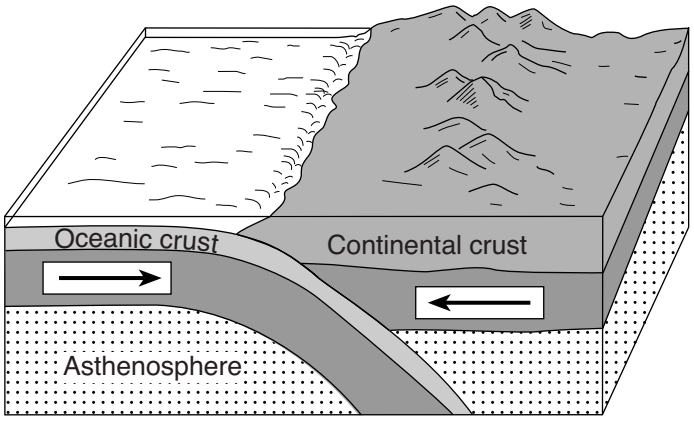
71 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— the greater the latitude, the greater the duration of insolation

— direct relationship

72 [1] Allow 1 credit if *both* arrows are correctly drawn and indicate convergence.

Example of a 1-credit response:



(Not drawn to scale)

73 [1] Allow 1 credit for Nazca Plate.

74 [1] Allow 1 credit for any value from 4 min 40 s to 4 min 50 s.

75 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Evacuate coastal areas.

— Move inland.

— Get to higher ground.

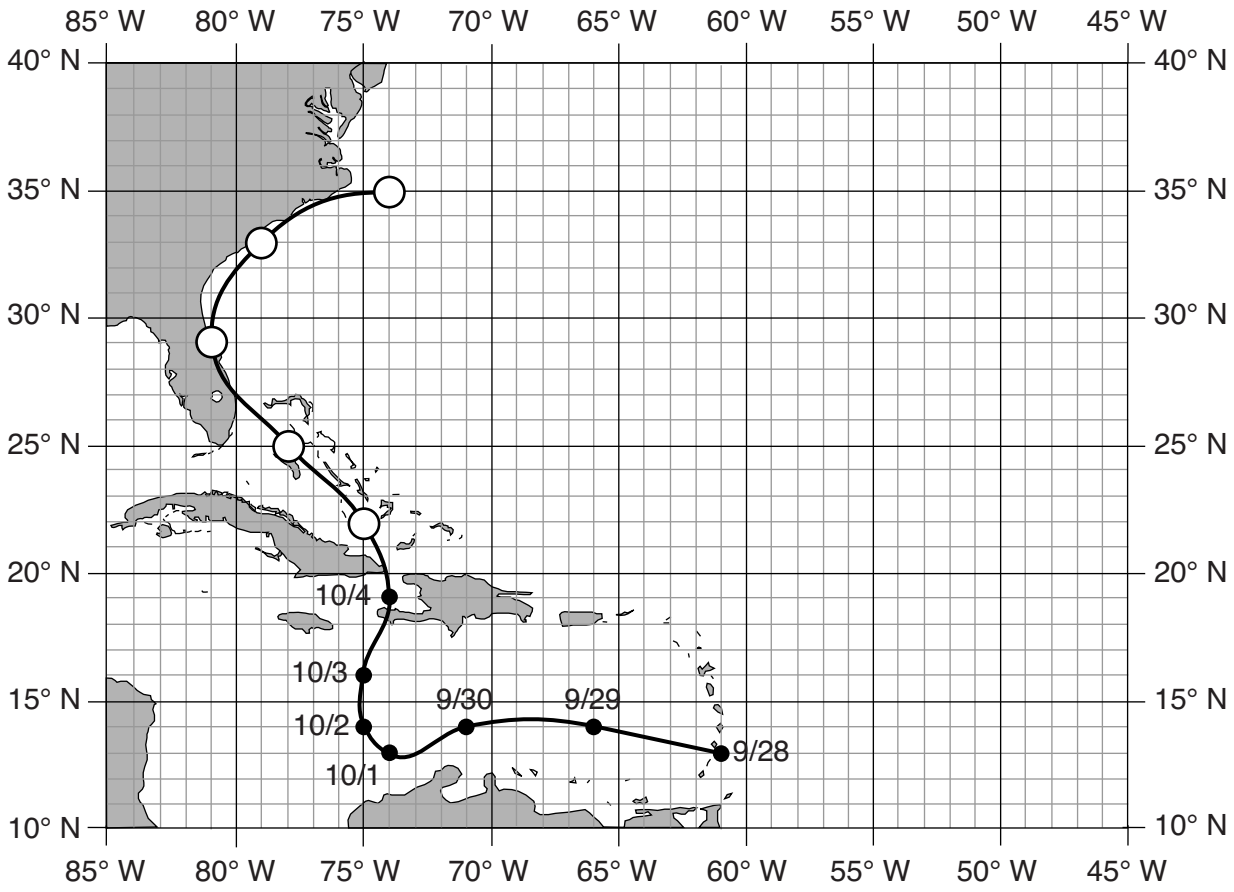
— Move to higher floors in buildings.

76 [1] Allow 1 credit if *all five* plots are within or touch the circles shown below and are correctly connected with a line (beginning at the 10/4 plot) 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.

Hurricane Tracking Map
Hurricane Matthew, Fall 2016



77 [1] Allow 1 credit for from Sept. 29 to Sept. 30 *or* from 9/29 to 9/30.

78 [1] Allow 1 credit for a wind speed of 145 mph and a Category 4/Cat 4 classification of hurricane.

79 [1] Allow 1 credit for *Cryptolithus* and *Valcouroceras*.

Note: Do *not* allow credit for *B* and *D* because these are not the names of the fossils.

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

— These organisms only existed for a short time.

— These fossils have widespread distribution.

81 [1] Allow 1 credit for limestone.

82 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— As the distance from *Kepler-11* increases, the period of revolution increases.

— As one increases, the other increases.

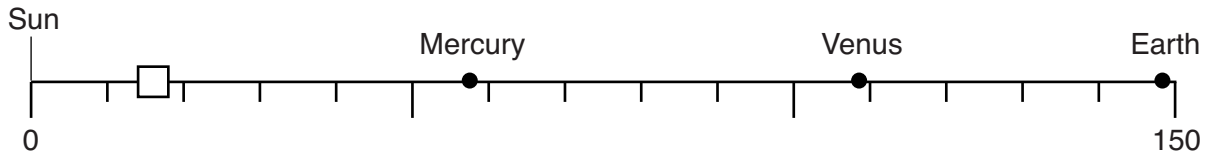
— the closer the planet, the smaller the period of revolution

— direct relationship

83 [1] Allow 1 credit if the center of the **X** is within or touches the edge of the box 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.



(Distances drawn to scale in million kilometers)

84 [1] Allow 1 credit for Uranus and Jupiter.

85 [1] Allow 1 credit for the Sun.

Regents Examination in Physical Setting/Earth Science

January 2020

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

The *Chart for Determining the Final Examination Score for the January 2020 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 24, 2020. 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 2020 Physical Setting/Earth Science			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1		51, 60	66, 67, 76
Math Key Idea 2	10, 18, 27	51, 60, 61	68, 71, 74, 77, 78, 82, 85
Math Key Idea 3			83
Science Inquiry Key Idea 1	1, 3, 4, 13, 23, 28, 31, 34	39, 40, 41, 43, 50, 54, 65	70, 80
Science Inquiry Key Idea 2		51	
Science Inquiry Key Idea 3	2, 7, 10, 11, 12, 14, 15, 16, 18, 19, 21, 23, 24, 25, 26, 27, 28, 30, 33, 35	36, 42, 44, 45, 48, 57, 58, 59, 60, 62, 63, 64	66, 71, 72, 73, 74, 79, 81, 84, 85
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1	6, 8, 9, 25, 29, 32	47, 53, 56	81
Key Idea 2	2, 5, 8, 9, 10, 11, 13, 17, 18, 19, 20, 22, 25, 31, 32, 34	37, 38, 39, 40, 46, 47, 48, 49, 50, 54, 55, 57, 59, 62, 63, 64	66, 67, 68, 69, 70, 71, 72, 73, 77, 78, 79, 80, 81
Key Idea 3	12, 22		68, 83
Key Idea 4			
Key Idea 5	9, 17, 20	45, 49, 50, 53, 54, 56	69, 84
Key Idea 6			
Standard 7			
Key Idea 1		58, 65	
Key Idea 2			75
Standard 4			
Key Idea 1	1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 14, 15, 21, 23	39, 40, 41, 42, 43, 44, 45, 49, 50, 51, 52, 53, 54, 62	69, 76, 79, 80, 81, 82, 83, 84, 85
Key Idea 2	10, 11, 13, 16, 17, 18, 19, 20, 22, 24, 25, 26, 27, 28, 29, 31, 32, 34	36, 46, 47, 48, 55, 56, 57, 58, 59, 60, 61, 65	66, 67, 68, 70, 71, 72, 73, 74, 75, 77, 78
Key Idea 3	30, 33, 35	37, 38, 63, 64	
Reference Tables			
ESRT 2011 Edition (Revised)	2, 7, 10, 11, 12, 14, 15, 16, 18, 19, 21, 24, 25, 26, 27, 28, 30, 33, 35	36, 42, 44, 45, 48, 57, 58, 59, 60, 62, 63, 64	66, 72, 73, 74, 79, 81, 84, 85

The State Education Department / The University of the State of New York

Regents Examination in Physical Setting/Earth Science – January 2020

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

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

Final Examination Scores
Regents Examination in Physical Setting/Earth Science – January 2020 – continued

Total Written Test Score	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	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	66	66	65	65	64	64	63	62	62	61	60	59	57	56	54	53	51
38	65	65	64	64	64	63	62	62	61	60	59	58	57	55	54	52	50
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	61	61	60	60	59	59	58	57	57	56	55	54	52	51	49	48	46
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	58	57	57	56	56	55	55	54	53	52	51	50	49	48	46	44	43
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	54	54	53	53	52	52	51	51	50	49	48	47	46	44	43	41	39
27	52	52	52	51	51	50	50	49	48	47	46	45	44	43	41	39	37
26	52	51	51	50	50	49	49	48	47	46	45	44	43	42	40	38	37
25	50	50	49	49	48	48	47	46	46	45	44	43	41	40	38	37	35
24	49	49	48	48	47	47	46	45	45	44	43	42	40	39	37	36	34
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	41	41	40	40	39	39	38	37	36	35	34	33	31	30	28	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	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