

PHYSICAL SETTING EARTH SCIENCE

Thursday, January 26, 2017 — 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 Which statement best explains why stars viewed from the Northern Hemisphere appear to revolve around *Polaris*?

- (1) *Polaris* rotates on its axis.
- (2) Earth rotates on its axis.
- (3) *Polaris* revolves around Earth.
- (4) Earth revolves around *Polaris*.

2 The hydrosphere covers approximately what percentage of Earth's lithosphere?

- (1) 100%
- (2) 70%
- (3) 50%
- (4) 25%

3 The deflection of prevailing winds and ocean currents in the Northern Hemisphere is called

- (1) eccentricity
- (2) refraction
- (3) the Coriolis effect
- (4) the Doppler effect

4 Earth's rate of revolution is approximately

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

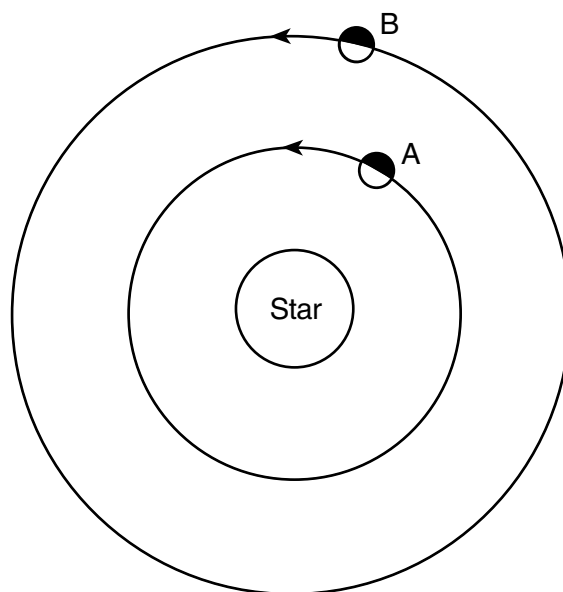
5 The asteroid Ceres lies at an average distance of 414 million kilometers from the Sun. The period of revolution of Ceres around the Sun is approximately

- (1) 438 days
- (2) 687 days
- (3) 4.6 years
- (4) 12.6 years

6 Which planet has a density that is *less* than the density of liquid water?

- (1) Mercury
- (2) Earth
- (3) Mars
- (4) Saturn

7 The diagram below represents two planets of equal mass, *A* and *B*, revolving around a star. The planets are represented at specific positions in their orbits.



(Not drawn to scale)

When both planets are at the positions represented, planet *B*

- (1) can be seen at night from planet *A*, and planet *B* is moving faster in its orbit
- (2) can be seen at night from planet *A*, and planet *B* is moving slower in its orbit
- (3) cannot be seen at night from planet *A*, and planet *B* is moving faster in its orbit
- (4) cannot be seen at night from planet *A*, and planet *B* is moving slower in its orbit

8 Compared to terrestrial planets, Jovian planets have

- (1) smaller equatorial diameters and shorter periods of revolution
- (2) smaller equatorial diameters and longer periods of revolution
- (3) larger equatorial diameters and shorter periods of revolution
- (4) larger equatorial diameters and longer periods of revolution

9 Clouds most likely form as a result of

- (1) moist air rising, compressing, and warming
- (2) moist air rising, expanding, and cooling
- (3) dry air rising, compressing, and warming
- (4) dry air rising, expanding, and cooling

10 The dewpoint is 15°C . What is the wet-bulb temperature on a sling psychrometer if the dry-bulb temperature is 18°C ?

- (1) 16°C
- (2) 2°C
- (3) 3°C
- (4) 20°C

11 Which weather instrument is used to measure air temperatures recorded on a weather map?

- (1) anemometer
- (2) wind vane
- (3) thermometer
- (4) barometer

12 Equal masses of basalt, granite, iron, and copper received the same amount of solar energy during the day. At night, which of these materials cooled down at the fastest rate?

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

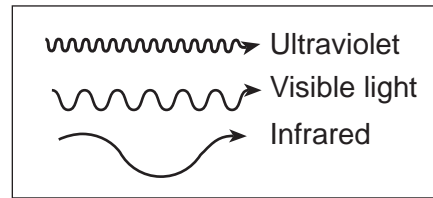
13 Equal areas of which type of surface will reflect the most insolation?

- (1) light gray rooftop
- (2) dark tropical forest
- (3) snow-covered field
- (4) black paved road

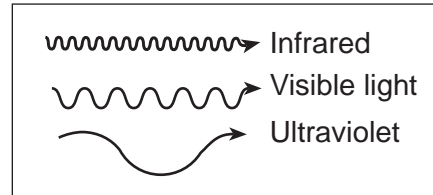
14 Riverhead, New York, has a smaller average daily temperature range than Elmira, New York, because Riverhead is located

- (1) near a large body of water
- (2) at a lower latitude
- (3) at a higher elevation
- (4) near a large city

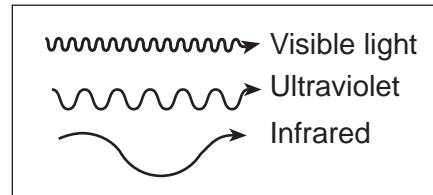
15 Which diagram best represents the relative wavelengths of visible light, ultraviolet energy, and infrared energy?



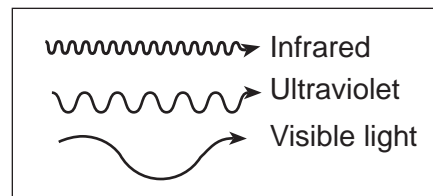
(1)



(2)



(3)



(4)

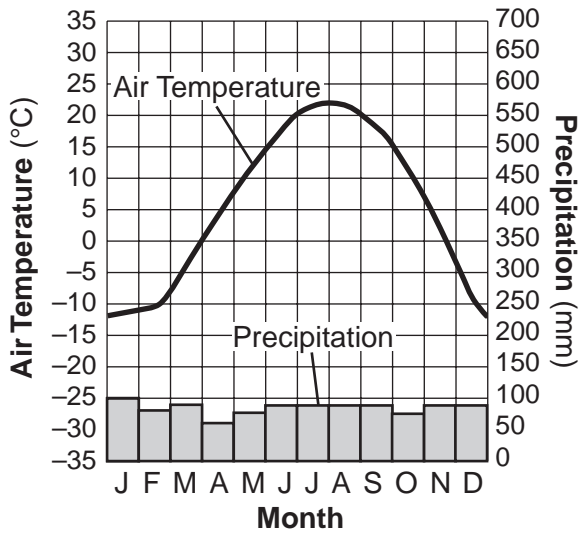
16 Volcanic ash is a good geologic time marker because the ash

- (1) is deposited rapidly over a large area
- (2) spreads evenly in all compass directions
- (3) is easily weathered and eroded
- (4) remains in the atmosphere for millions of years

17 The change in life-forms in the fossil record from less complex organisms to more complex organisms over time is best explained by

- (1) extinction
- (2) evolution
- (3) dynamic equilibrium
- (4) original horizontality

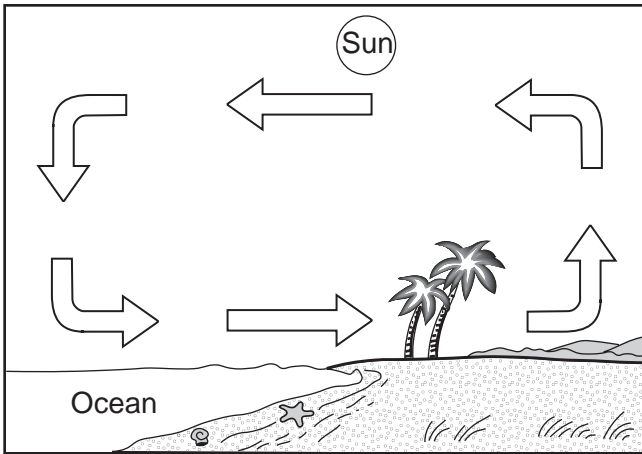
18 The graph below shows the yearly air temperature and precipitation of a location on Earth.



This location would be most likely at a latitude of

(1) 0° (3) 50° N
 (2) 35° S (4) 90° N

19 Arrows in the diagram below represent the daytime flow of air over a coastal region.



Which process primarily transfers heat by moving air?

(1) conduction (3) radiation
 (2) convection (4) transpiration

20 The graph below shows the radioactive decay of rubidium-87.



What percentage of rubidium-87 atoms will be left after four half-lives?

- (1) 25.0% (3) 6.25%
 (2) 12.5% (4) 3.125%

21 The pressure at the interface between Earth's outer core and inner core is inferred to be

- (1) 0.2 million atmospheres
 (2) 1.5 million atmospheres
 (3) 3.1 million atmospheres
 (4) 3.6 million atmospheres

22 Which type of tectonic plate boundary is found between the South American Plate and the Scotia Plate?

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

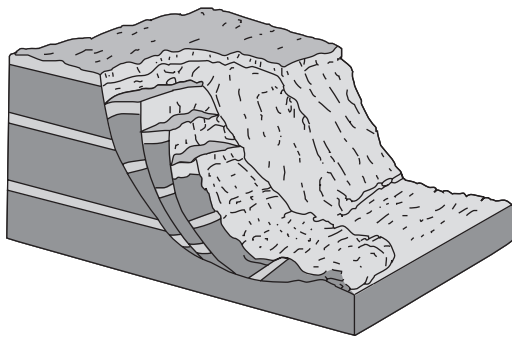
23 The epicenter of an earthquake was located 1800 kilometers from a seismic recording station. If the S-wave arrived at the seismic station at 10:06:40 a.m., at what time did the P-wave arrive at the same seismic station?

- (1) 10:03:00 a.m. (3) 10:09:40 a.m.
 (2) 10:03:40 a.m. (4) 10:10:20 a.m.

24 A strong earthquake that occurs on the ocean floor could result in the formation of

- (1) a tsunami (3) an El Niño event
 (2) a delta (4) an ocean current

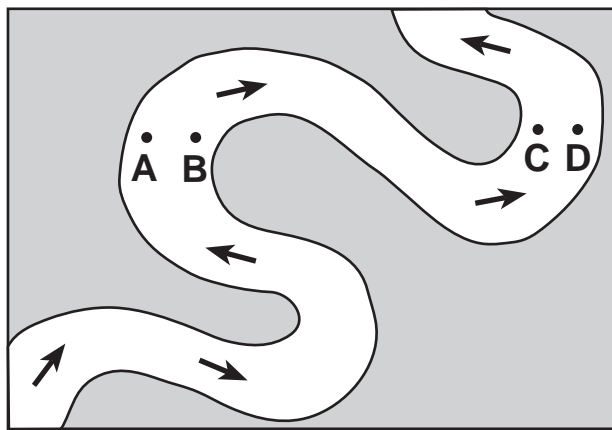
25 The block diagram below represents a rapid downslope flow of saturated soil and rock layers.



What are two likely causes of this rapid downslope flow?

- (1) groundwater and abrasion
- (2) groundwater and gravity
- (3) prevailing wind and abrasion
- (4) prevailing wind and gravity

26 The map below shows a stream. Letters A, B, C, and D represent locations on the stream surface. Arrows represent the direction of stream flow.



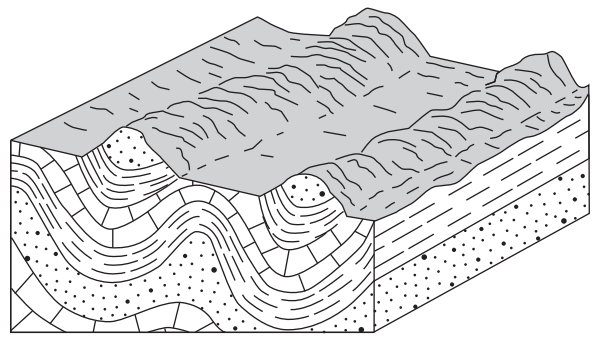
Which two locations have the greatest stream velocities?

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

27 Which climate conditions most likely produce a landscape with rounded hills, large river valleys with many tributaries, and tropical vegetation?

- (1) cool and arid
- (2) cool and humid
- (3) warm and arid
- (4) warm and humid

28 The block diagram below represents two parallel mountain ranges.



Which two geologic processes most likely created this landscape region?

- (1) volcanism, followed by metamorphism
- (2) faulting, followed by deposition
- (3) folding, followed by erosion
- (4) glaciation, followed by rifting

29 Which agent of erosion most likely moves sediments in a sand dune?

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

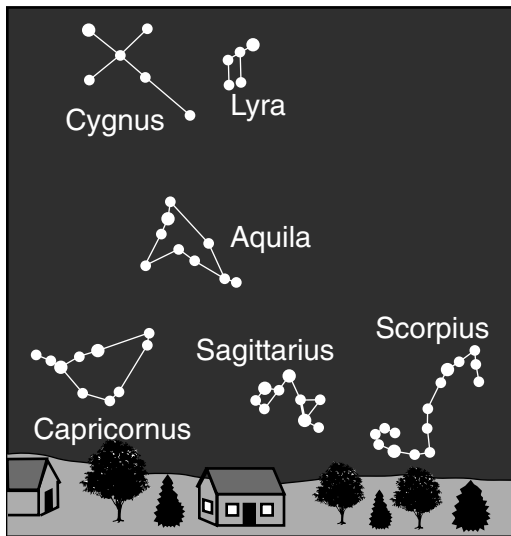
30 Which rock is composed of a mineral that can be used for the production of cement?

- (1) basalt
- (2) limestone
- (3) rock salt
- (4) rock gypsum

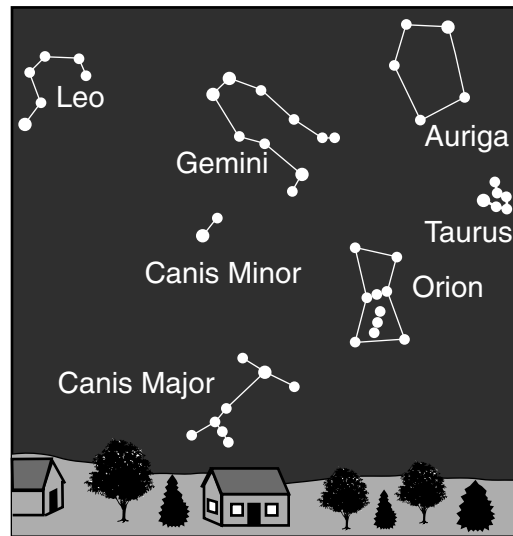
31 On April 21, the altitude of *Polaris*, as viewed from a location in New York State, was measured as 41.3° . What will the altitude of *Polaris* be when viewed one month later, on May 21, from the same location?

- (1) 23.5°
- (2) 41.3°
- (3) 66.7°
- (4) 90°

32 The diagrams below represent constellations seen by an observer in New York State facing south at midnight on July 7 and January 3.



Southern horizon – July 7



Southern horizon – January 3

Which motion causes the observer to see different constellations at midnight on July 7 compared to midnight on January 3?

- (1) revolution of the constellations in their orbits
- (2) revolution of Earth in its orbit
- (3) rotation of the stars in the constellations
- (4) rotation of Earth on its axis

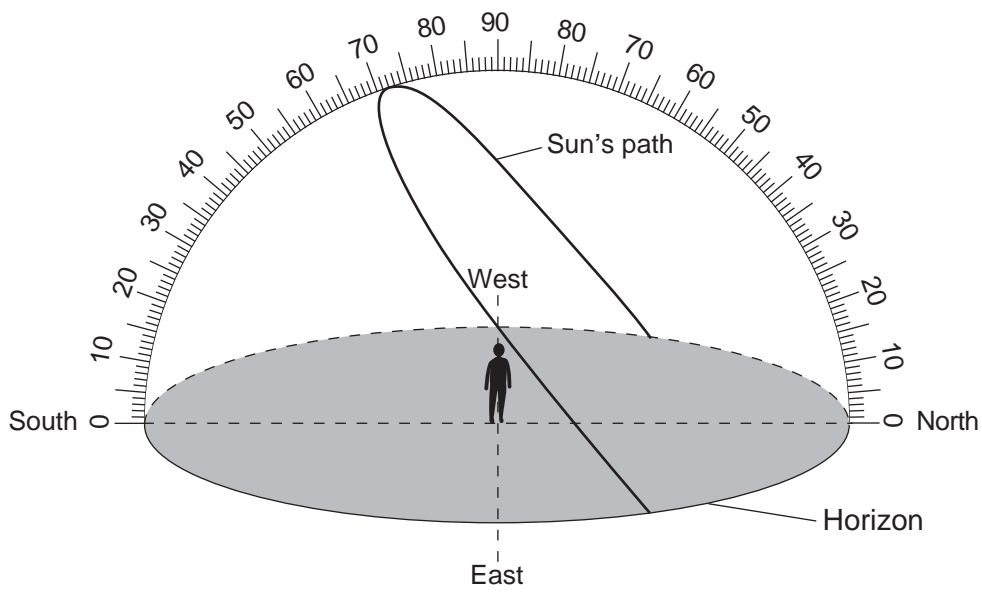
33 The diagram below represents a model of the size of the Sun and indicates the color of the Sun.



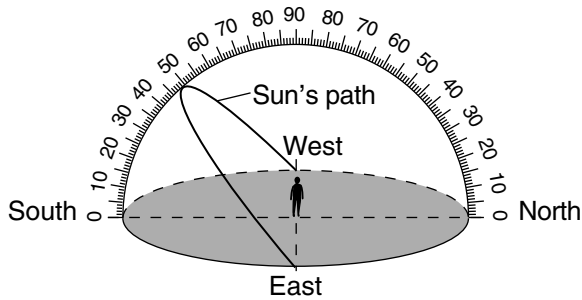
Which diagram best represents the relative size and indicates the color of *Polaris* compared to the Sun?

	Red star		Yellow star
(1)	(2)	(3)	(4)

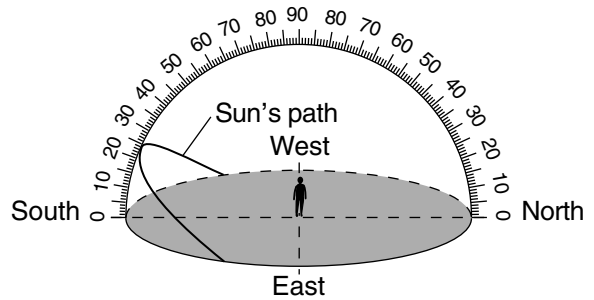
34 The diagram below represents the apparent path of the Sun as seen by an observer on June 21 at a location in New York State.



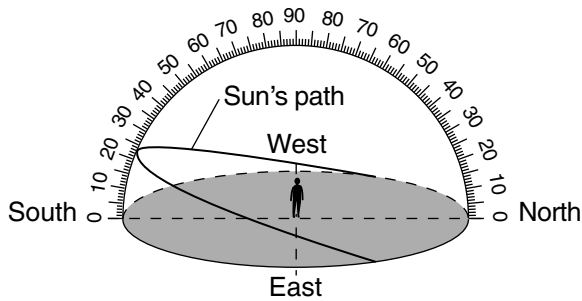
Which diagram best represents the apparent path of the Sun at this same location on December 21?



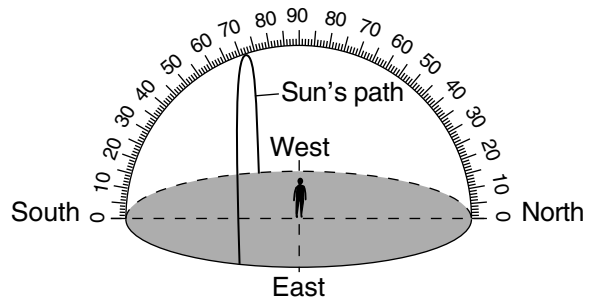
(1)



(3)

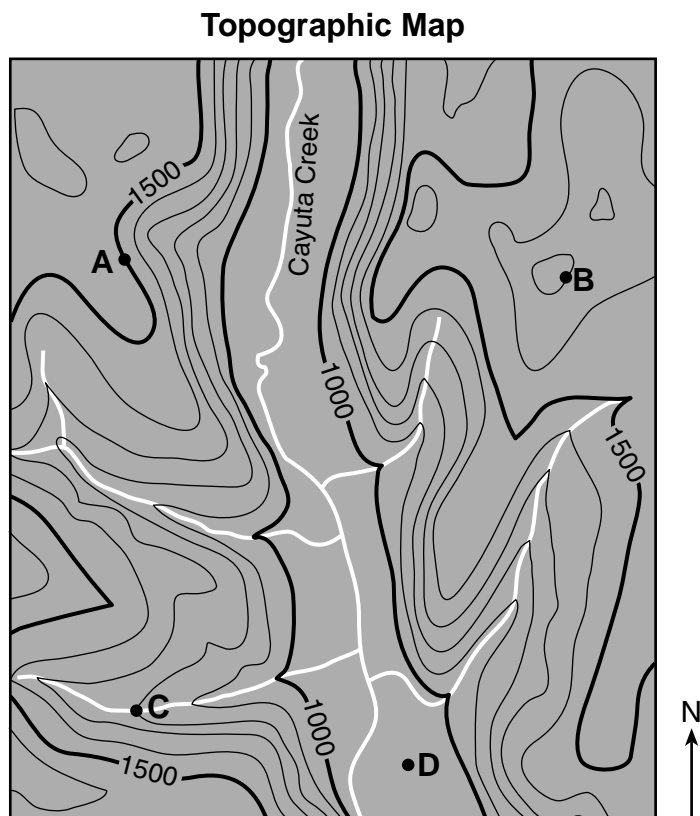


(2)



(4)

35 The topographic map below shows a portion of the Cayuta Creek that is located in New York State. Points A, B, C, and D represent locations on Earth's surface.



Which point on the map most likely represents a location within the flood plain associated with Cayuta Creek?

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

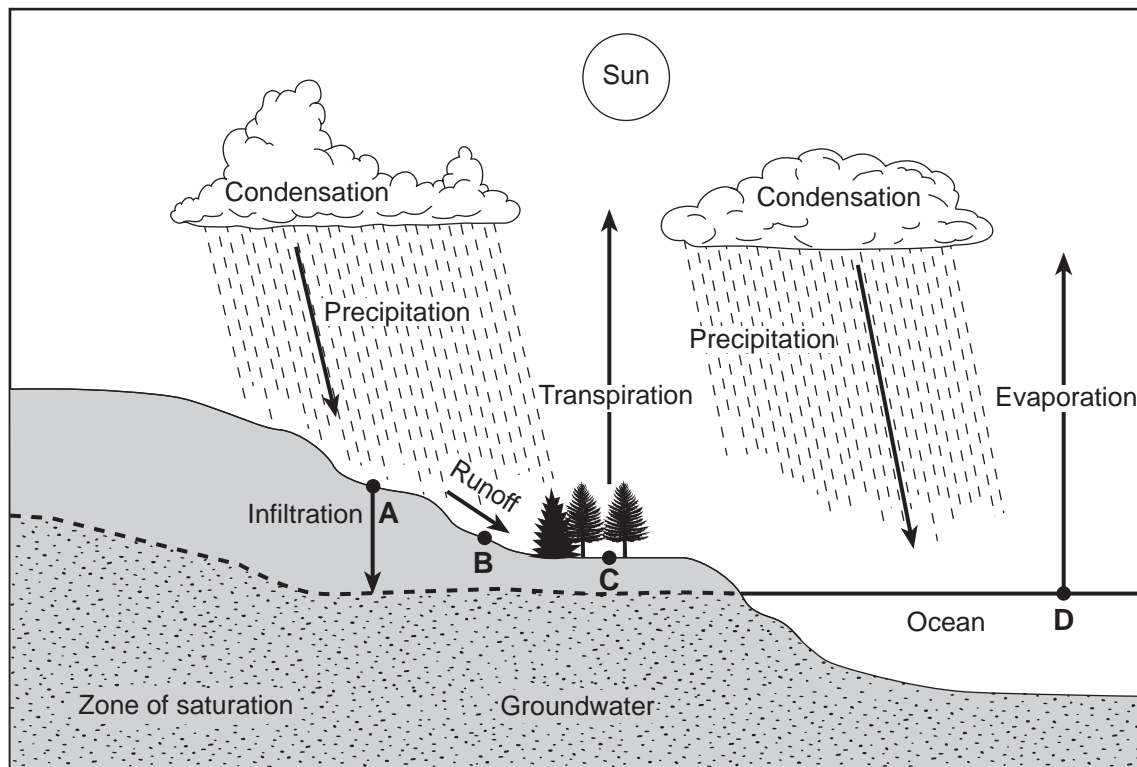
Part B-1

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.

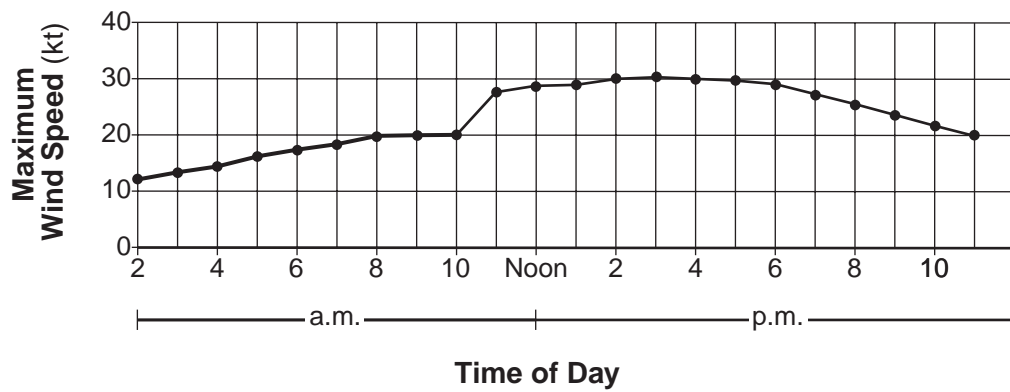
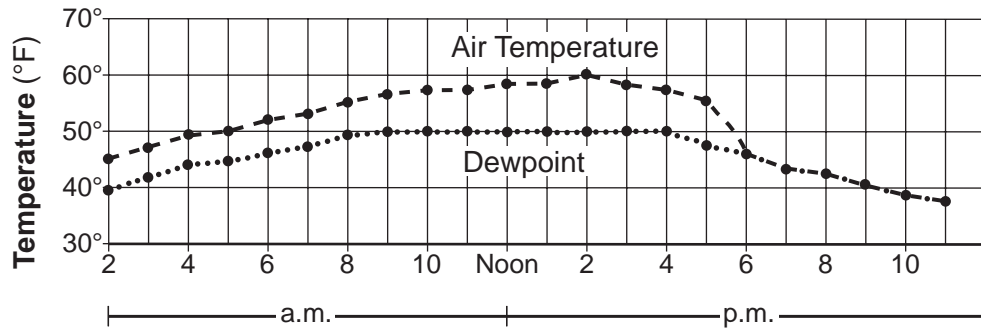
Base your answers to questions 36 through 38 on the cross section below and on your knowledge of Earth science. The cross section represents processes in the water cycle. Arrows represent the movement of water. Letters A, B, C, and D represent locations on Earth's surface.

The Water Cycle



- 36 The downward movement of water from location A will usually be greatest when the soil is
- (1) nonporous and the particles are uniformly small in size
 - (2) nonporous and the particles are uniformly large in size
 - (3) porous and the particles are uniformly small in size
 - (4) porous and the particles are uniformly large in size
- 37 What would most likely reduce the amount of runoff at location B?
- (1) infiltration occurring faster than precipitation
 - (2) greater condensation than evaporation
 - (3) saturated soil below the land surface
 - (4) a frozen land surface
- 38 The greatest amount of transpiration and evaporation will occur most likely when the air temperature is
- (1) low and the humidity is low
 - (2) low and the humidity is high
 - (3) high and the humidity is low
 - (4) high and the humidity is high

Base your answers to questions 39 and 40 on the graphs below and on your knowledge of Earth science. The graphs show air temperatures and dewpoints in °F, and wind speeds in knots (kt) from 2:00 a.m. to 11:00 p.m. at a certain New York State location.



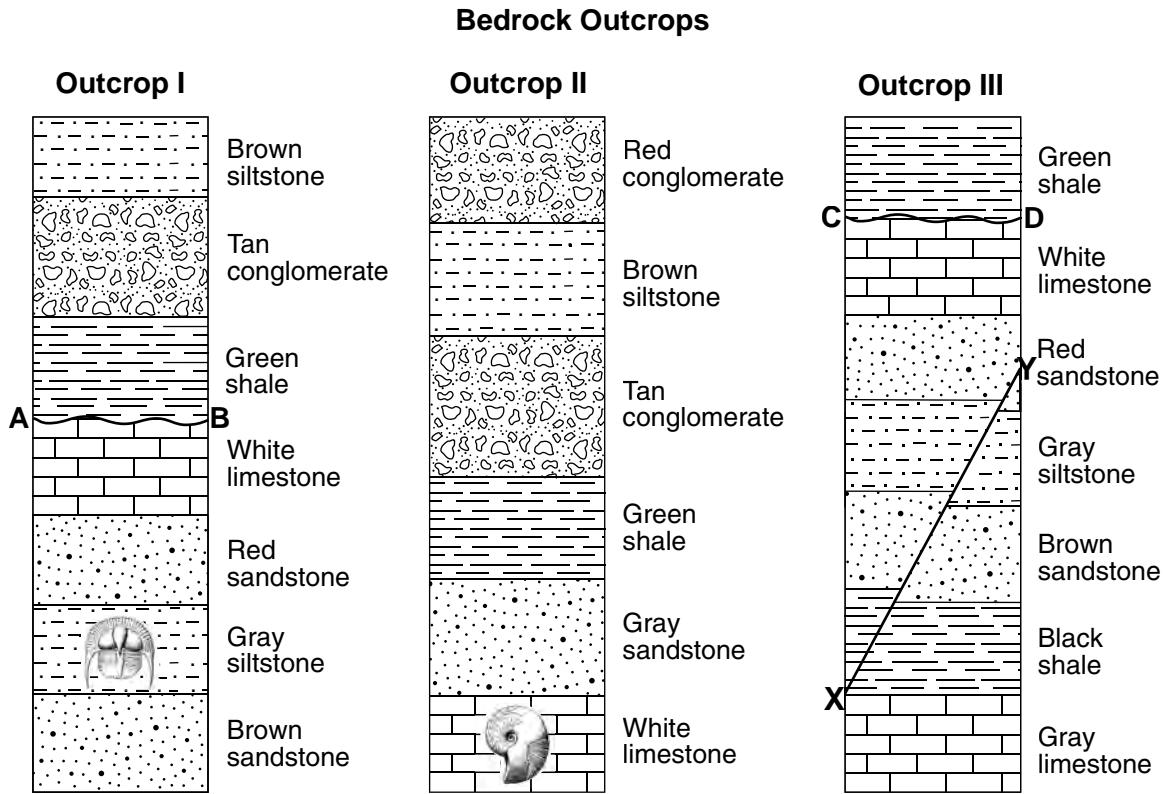
39 Which station model represents the weather data for this location at 4:00 p.m.?

40 58 (1)	50 58 (2)	58 40 (3)	58 50 (4)
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40 What was the relative humidity at 8:00 p.m.?

- (1) 30%
- (2) 45%
- (3) 75%
- (4) 100%

Base your answers to questions 41 through 44 on the three bedrock outcrops below and on your knowledge of Earth science. The outcrops, labeled I, II, and III, are located within 15 kilometers of each other. Lines *AB* and *CD* represent unconformities. Line *XY* represents a fault. No overturning of the layers has occurred.



- 41 Which layer is the youngest?
- (1) gray limestone
 - (2) red conglomerate
 - (3) brown siltstone
 - (4) brown sandstone
- 42 The unconformities at *AB* and *CD* resulted from
- (1) uplift and erosion, followed by subsidence and deposition
 - (2) movement along a crack between two rock layers
 - (3) contact metamorphism between two sedimentary layers
 - (4) regional metamorphism of deeply buried sedimentary rocks
- 43 Based on evidence shown in the diagram, which rock layer is older than fault *XY*?
- (1) tan conglomerate
 - (2) black shale
 - (3) brown siltstone
 - (4) white limestone
- 44 Which processes produced the brown siltstone layer in outcrops I and II?
- (1) cooling and solidification of mafic lava at Earth's surface
 - (2) cooling and solidification of felsic magma deep within Earth
 - (3) compaction and cementation of rock fragments ranging in size from 0.006 to 0.2 centimeter in diameter
 - (4) compaction and cementation of rock fragments ranging in size from 0.0004 to 0.006 centimeter in diameter

Base your answers to questions 45 through 47 on the passage below and on your knowledge of Earth science.

Island Arcs

Island arcs are long, curved chains of oceanic islands associated with seismic activity and mountain-building processes at certain plate boundaries. They occur where oceanic tectonic plates collide. Along one side of these island arcs, there is usually a long, narrow deep-sea trench.

At island arcs, the denser plate is subducted and is forced into the partially molten mantle under the less dense plate. The islands are composed of the extrusive igneous rocks basalt and andesite. The basalt originates most likely from the plastic mantle. The andesite originates most likely from the melting of parts of the descending plate and sediments that had accumulated on its surface.

45 An island arc is found along the

- (1) East Pacific Ridge
- (2) Iceland Hot Spot
- (3) Aleutian Trench
- (4) Peru-Chile Trench

46 Most of the basalt that forms island arcs comes from the

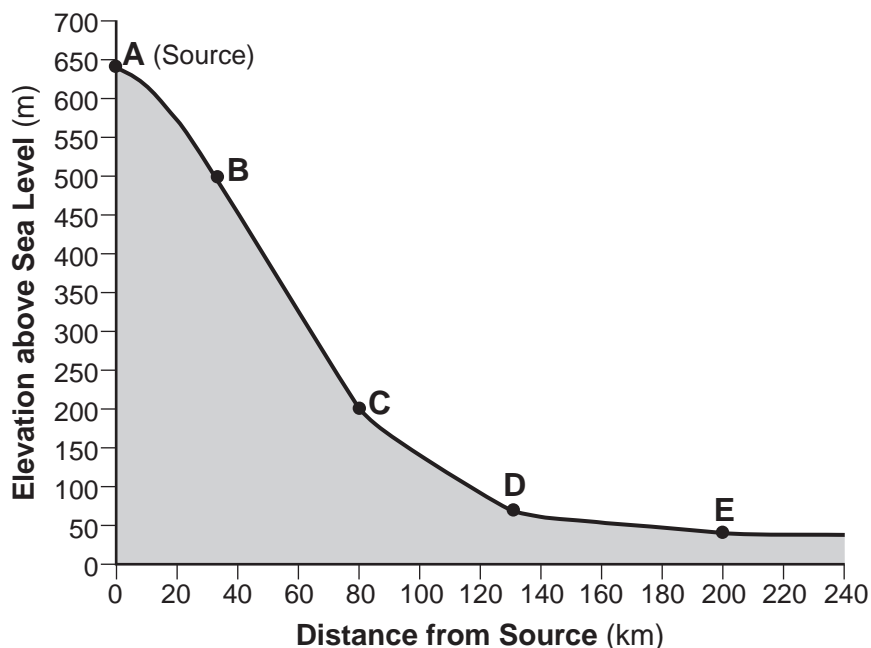
- (1) crust
- (2) rigid mantle
- (3) asthenosphere
- (4) stiffer mantle

47 Which list identifies minerals present in andesite from the greatest percentage by volume to the least percentage by volume?

- (1) biotite, plagioclase feldspar, amphibole
 - (2) biotite, amphibole, plagioclase feldspar
 - (3) plagioclase feldspar, biotite, amphibole
 - (4) plagioclase feldspar, amphibole, biotite
-

Base your answers to questions 48 through 50 on the cross section and data table below and on your knowledge of Earth science. The cross section shows the profile of a stream that is flowing down a valley from its source. Points *A* through *E* represent locations in the stream. The data table shows the average stream velocity at each location. The volume of water in the stream remains the same at all locations.

Stream Profile



Location in Stream	Average Stream Velocity (cm/s)
A	10
B	110
C	130
D	20
E	15

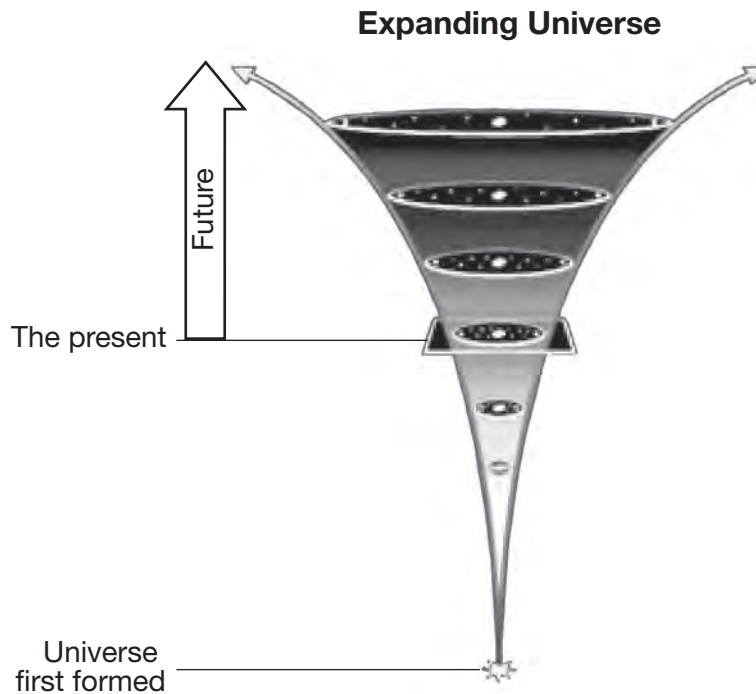
- 48 The average stream velocity at each location is controlled primarily by the
- (1) elevation above sea level
 - (2) slope of the land
 - (3) sediment carried by the stream
 - (4) distance from the stream's source
- 49 What is the largest type of sediment that could be transported at location *B*?
- (1) silt
 - (2) sand
 - (3) pebbles
 - (4) cobbles
- 50 Which features could be formed by the stream between locations *D* and *E*?
- (1) meanders
 - (2) kettle lakes
 - (3) barrier islands
 - (4) drumlins

Part B–2

Answer all questions in this part.

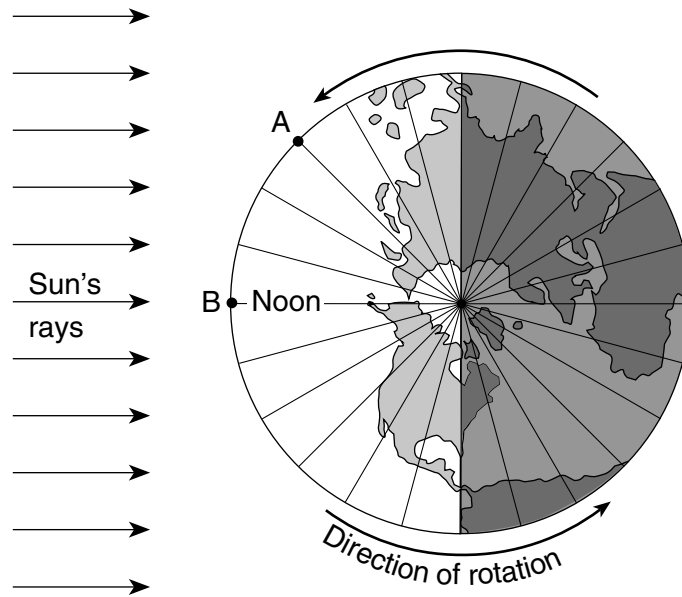
Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Earth Science*.

Base your answers to questions 51 through 54 on the diagram below and on your knowledge of Earth science. The diagram represents a model of the expanding universe.



- 51 Identify the name of the event that is inferred by scientists to have occurred when the universe first formed. [1]
- 52 Identify *one* piece of evidence that led astronomers to infer that the universe is expanding. [1]
- 53 Identify the force that caused stars and planets in the universe to become layered according to density differences in their composition. [1]
- 54 Identify the nuclear process that combines lighter elements into heavier elements to produce the energy radiated by stars. [1]
-

Base your answers to questions 55 and 56 on the diagram below and on your knowledge of Earth science. The diagram represents a view of Earth from above the North Pole, showing longitude lines at 15 degree intervals. Letters *A* and *B* represent surface locations on the equator.



55 Identify *one* date represented by this diagram. [1]

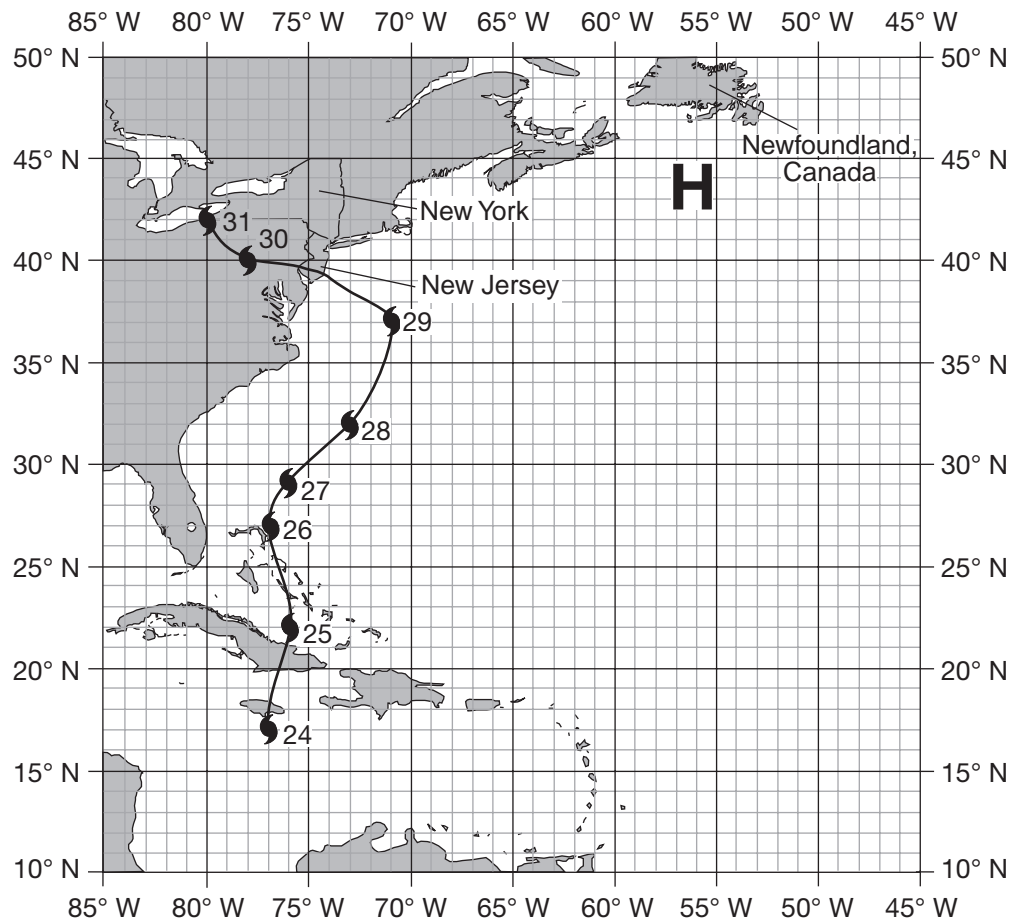
56 State the time at location *A* when it is noon at location *B*. Indicate a.m. or p.m. in your answer. [1]

Base your answers to questions 57 through 60 on the passage and map below and on your knowledge of Earth science. The map shows the positions of the eye (center) of Hurricane Sandy in its path from October 24 to October 31, 2012. A high-pressure center (H) is shown on the map.

Hurricane Sandy

In October 2012, Hurricane Sandy produced extreme damage to New York City and the coast of New Jersey due to high winds and a high storm surge. A storm surge is the rise in the level of ocean water along a coast that is caused by strong winds blowing toward land from a severe storm. High ocean tides, occurring at the same time, added to the height of the storm surge. A high-pressure center, located just south of Newfoundland, Canada, affected Hurricane Sandy by altering the path of the jet stream. This change in the jet stream, combined with surface wind circulation around the high-pressure center, caused Hurricane Sandy to curve westward, making landfall along the coast of New Jersey.

**Path of Hurricane Sandy from
October 24, 2012 to October 31, 2012**



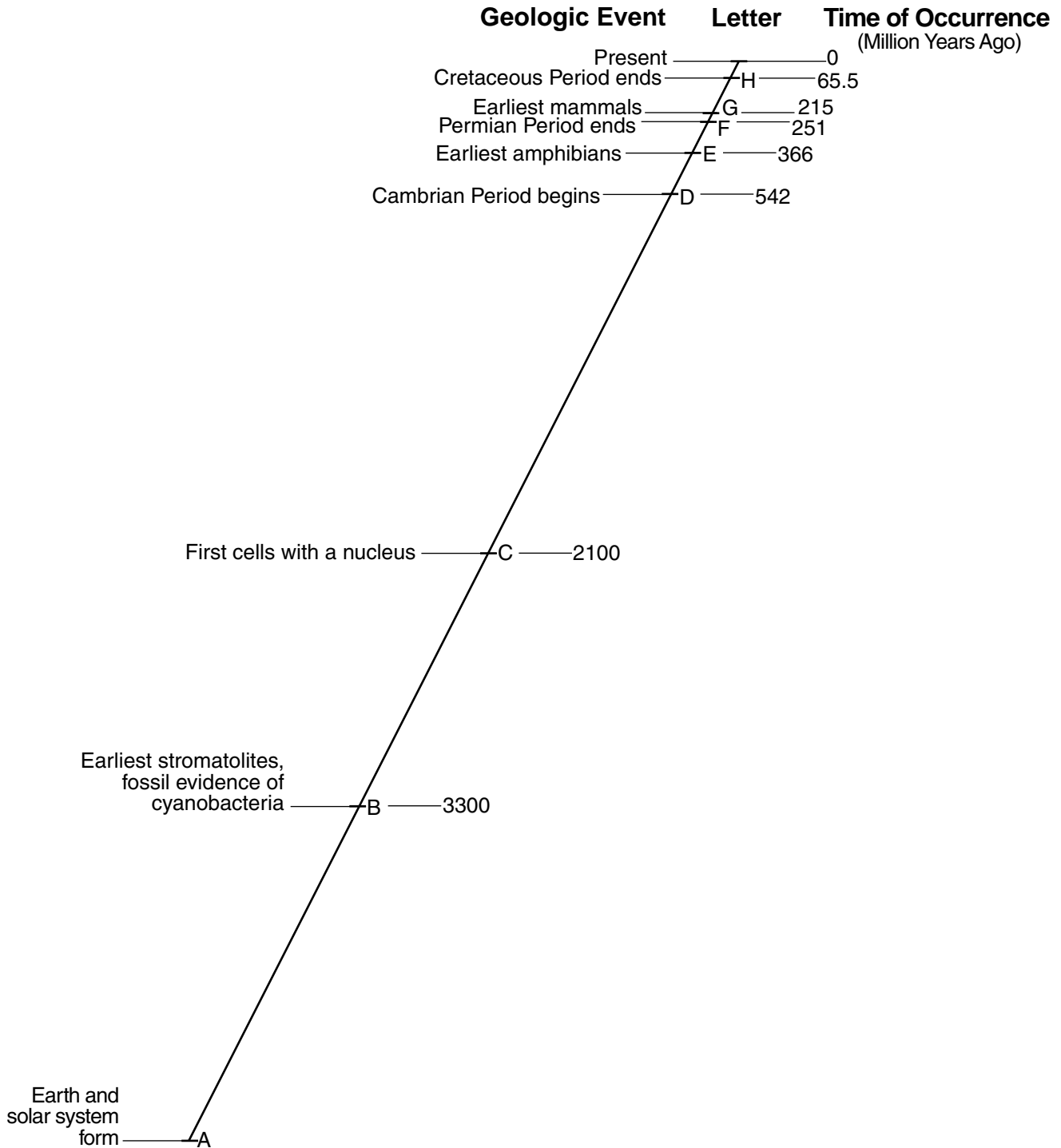
- 57 Using information from the map, complete the data table *in your answer booklet* by identifying the latitude and longitude positions of the eye of Hurricane Sandy from October 27, 2012 to October 29, 2012. Express your latitude and longitude positions to the nearest whole degree. [1]
- 58 Describe the surface wind circulation around the high-pressure center (**H**) that is located south of Newfoundland. [1]
- 59 The data table below shows the air pressure, measured in millibars (mb), and surface wind speed, measured in miles per hour (mi/h), recorded near the center of Hurricane Sandy on three separate days.

Date	Air Pressure (mb)	Surface Wind Speed (mi/h)
October 24, 2012	973	70
October 27, 2012	958	75
October 29, 2012	943	90

On the set of axes *in your answer booklet*, draw a line to represent the general relationship between air pressure and surface wind speed associated with Hurricane Sandy for these three days. [1]

- 60 Explain why Hurricane Sandy weakened on October 30 and October 31. [1]
-

Base your answers to questions 61 through 65 on the geologic timeline below and on your knowledge of Earth science. The geologic timeline, drawn to scale, represents Earth's geologic history. The letters A through H on the timeline represent the times of occurrence for specific, labeled geologic events. The time of occurrence for letter A has been omitted.



- 61 Identify the *two* consecutive letters on the timeline that represent the time span within which the earliest insects appeared on Earth. [1]
- 62 State the time of occurrence for the geologic event labeled *A* on the geologic timeline. [1]
- 63 Describe the major change in Earth's atmosphere that was occurring at the time when the first cells with a nucleus appeared on Earth. [1]
- 64 The table below lists the five major mass extinctions that occurred on Earth during the Paleozoic and Mesozoic Eras.

Time of Mass Extinction	Description of Mass Extinction Events
Letter <i>H</i> on timeline	Dinosaurs, along with 80% of all organisms
End of Triassic	Most ammonoids, many brachiopods and gastropods, 80% of four-legged animals
Letter <i>F</i> on timeline	Largest mass extinction in history, 90% of all species
Late Devonian	70-80% of marine species
Late Ordovician	85% of marine species

Identify the group of marine organisms found in the *2011 Edition Reference Tables for Physical Setting/Earth Science* that became extinct during the largest mass extinction in history. [1]

- 65 Identify the geologic eon during which event letter *B* occurred. [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 69 on the data table below and on your knowledge of Earth science. The data table shows the average level of atmospheric carbon dioxide (CO₂), measured in parts per million (ppm), for the month of February at the Mauna Loa observatory in Hawaii from 2008 to 2014.

Year	Average February Atmospheric CO ₂ Levels (ppm)
2008	386
2009	387
2010	390
2011	392
2012	394
2013	396
2014	398

- 66 On the grid *in your answer booklet*, construct a line graph by plotting the data for the average February atmospheric carbon dioxide (CO₂) levels for the years 2008 to 2014. Connect the plots with a line. [1]
- 67 These measurements of atmospheric carbon dioxide were collected at an altitude of 3.4 kilometers. Identify the temperature zone of the atmosphere where these data were collected. [1]
- 68 Identify *one* major greenhouse gas, other than carbon dioxide. [1]
- 69 Describe *two* human activities that would *decrease* the amount of carbon dioxide that humans add to Earth's atmosphere. [1]
-

Base your answers to questions 70 through 73 on the weather map in your answer booklet and on your knowledge of Earth science. The weather map shows the center of a high-pressure system (**H**) and the center of a low-pressure system (**L**) affecting North America. Isobars are drawn for the eastern portion of the map, and one isobar is drawn around the high-pressure center. Air pressures are shown at various points in the western portion of the map. All air pressures were recorded in millibars (mb). Points *A* through *F* represent surface locations.

70 On the map *in your answer booklet*, draw the 1012 mb, 1016 mb, and 1020 mb isobars. Extend the isobars to the edges of the map. [1]

71 Convert the air pressure at location *A* from millibars (mb) to inches of mercury (in of Hg). [1]

72 Calculate the air pressure gradient between locations *A* and *B* in millibars per kilometer. [1]

73 Identify *one* possible air pressure at the center of the low-pressure system. [1]

Base your answers to questions 74 through 77 on the diagram in your answer booklet and on your knowledge of Earth science. The diagram represents the Moon's orbit around Earth as viewed from space above Earth's North Pole (NP). Letter *A* represents one position of the Moon in its orbit.

74 On the diagram *in your answer booklet*, place an **X** on the Moon's orbit to indicate the position of the Moon when a solar eclipse would be observed from Earth. [1]

75 State the number of days that it takes the Moon to orbit Earth once. [1]

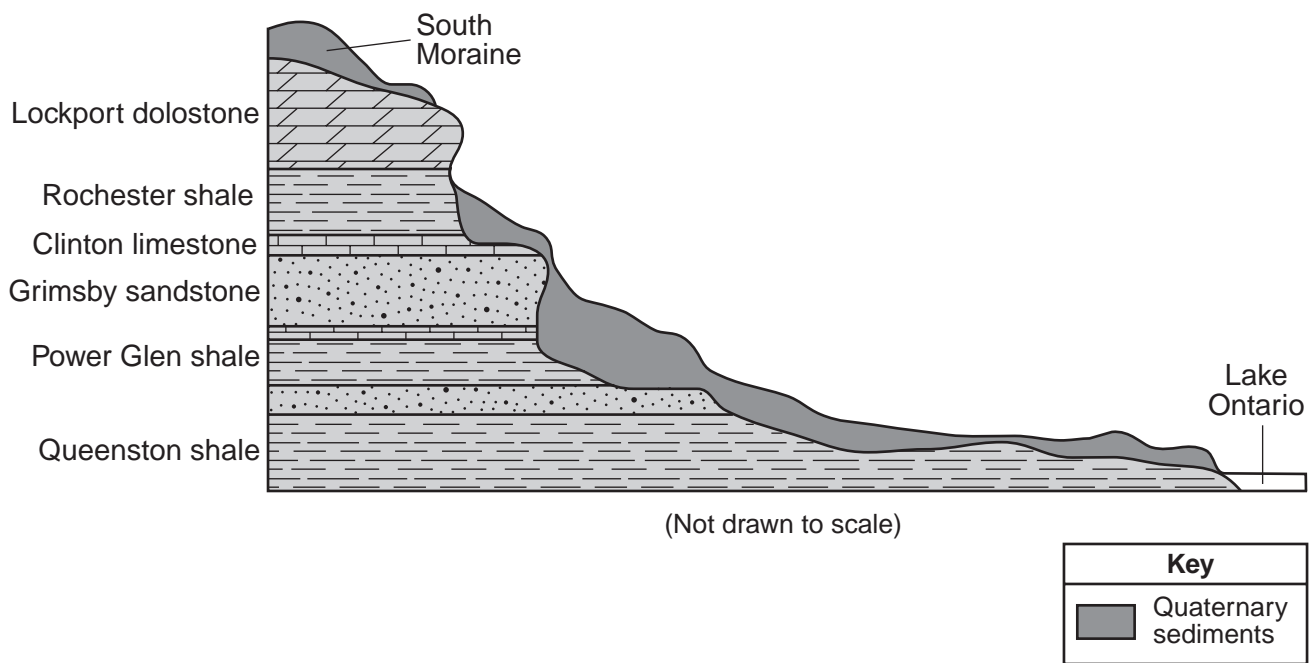
76 On the diagram *in your answer booklet*, shade the portion of the Moon that is in darkness as viewed from New York State when the Moon is at position *A*. [1]

77 Describe the actual shape of the Moon's orbit. [1]

Base your answers to questions 78 through 81 on the passage and geologic cross section below and on your knowledge of Earth science. The geologic cross section represents rock layers of a portion of the Niagara Escarpment, and landscape features that are found in the Niagara region. The rock layers have *not* been overturned.

The Niagara Escarpment

A prominent feature found along the shore of Lake Ontario in western New York State is the Niagara Escarpment. This escarpment is the remains of an ancient seabed that was formed when the area was covered by a warm, shallow sea from approximately 450 to 430 million years ago. Erosion of the Taconic Mountains to the east provided the sediments deposited in this basin area. From these sediments, rock layers such as shale, sandstone, and limestone formed. Later, magnesium replaced some of the calcium in the top layer of limestone, turning it into a dolostone layer. When the high ocean levels of the Ordovician Period dropped, the draining of this inland sea caused unequal erosion of the exposed layers. The South Moraine was deposited on the top of the Niagara Escarpment in this region.



- 78 Identify the New York State landscape region in which the Niagara Escarpment is located. [1]
- 79 Identify the mineral composition of the Lockport dolostone. [1]
- 80 Describe the inferred position of North America when this area was covered by the warm, shallow sea. [1]
- 81 Describe the tectonic event that caused the Taconian orogeny. [1]

Base your answers to questions 82 through 85 on the photographs below and on your knowledge of Earth science. The photographs show eight common rock-forming minerals.

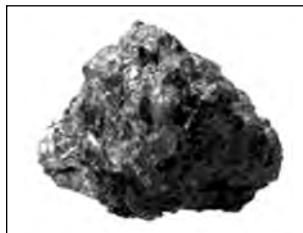
Biotite mica



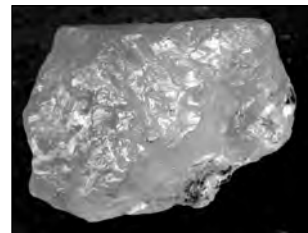
Potassium feldspar



Olivine



Quartz



Muscovite mica



Plagioclase feldspar



Amphibole



Pyroxene



82 Identify the mineral shown that can scratch all of the other minerals shown. [1]

83 In the table *in your answer booklet*, place an **X** in the appropriate box to indicate whether each mineral is found mainly in felsic or mafic igneous rock. [1]

84 Identify the *two* most abundant elements, by mass, in Earth's crust that are part of the composition of all eight of these minerals. [1]

85 Identify the *two* minerals shown that exhibit fracture as a dominant form of breakage. [1]

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

**PHYSICAL SETTING
EARTH SCIENCE**

Thursday, January 26, 2017 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

Student Sex: Male
 Female
Teacher
School Grade

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

Part B–2

51 _____

52 _____

53 _____

54 _____

55 _____

56 _____

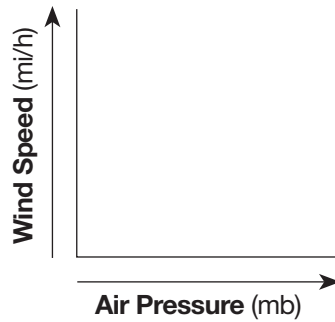
57

**Position of Hurricane Sandy from
October 24, 2012 to October 31, 2012**

Date	Latitude° (N)	Longitude° (W)
October 24	17	77
October 25	22	76
October 26	27	77
October 27		
October 28		
October 29		
October 30	40	78
October 31	42	80

58

59



60

61 _____ and _____

62 _____ **million years ago**

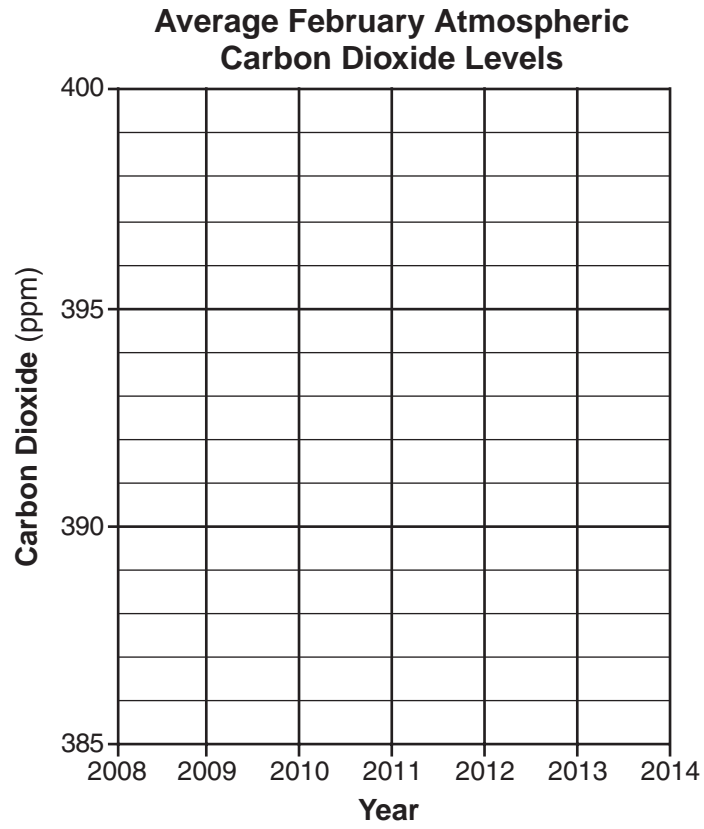
63 _____

64 _____

65 _____

Part C

66



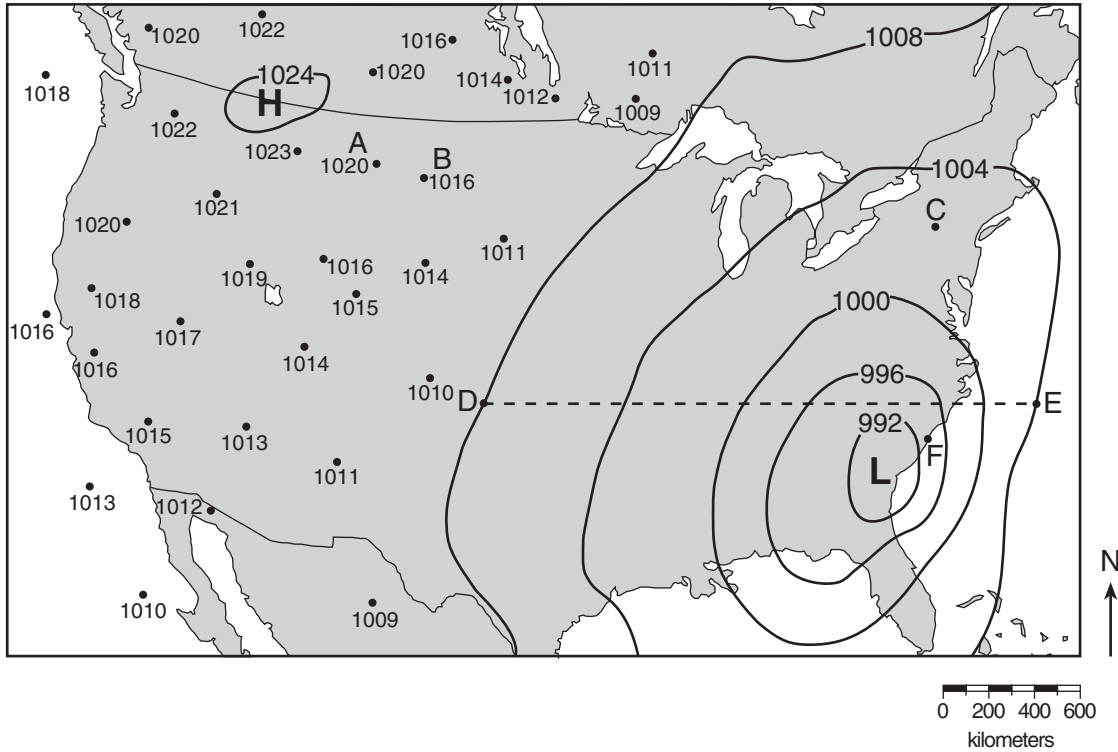
67 _____

68 _____

69 (1) _____

(2) _____

70

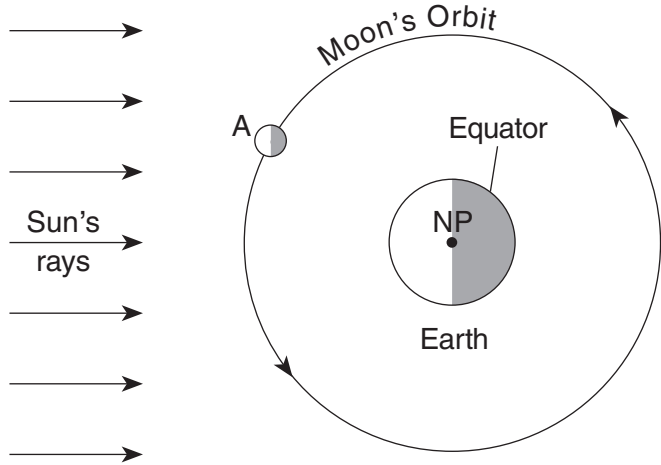


71 _____ in of Hg

72 _____ mb/km

73 _____ mb

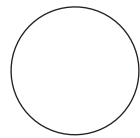
74



(Not drawn to scale)

75 _____ d

76



77 _____

78 _____

79 _____

80 _____

81 _____

82 _____

83

Mineral Name	Felsic	Mafic
Potassium feldspar		
Olivine		
Quartz		
Pyroxene		

84 _____ and _____

85 _____ and _____

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 26, 2017 — 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 2	10 1	19 2	28 3
2 2	11 3	20 3	29 1
3 3	12 4	21 3	30 2
4 1	13 3	22 1	31 2
5 3	14 1	23 2	32 2
6 4	15 1	24 1	33 4
7 2	16 1	25 2	34 3
8 4	17 2	26 4	35 4
9 2	18 3	27 4	

Part B–1

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

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 26, 2017. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

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

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

Part B–2

Allow a maximum of 15 credits for this part.

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

51 [1] Allow 1 credit for Big Bang *or* Big Bang Theory.

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

- red shift
- cosmic background radiation
- Doppler Effect
- Galaxies are moving away from each other.
- Galaxies are moving away from Earth.
- gravity waves

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

- gravity
- gravitational attraction/gravitational pull

54 [1] Allow 1 credit for fusion *or* nuclear fusion.

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

- March 19 *or* March 20 *or* March 21 *or* March 22
- Sept. 21 *or* Sept. 22 *or* Sept. 23 *or* September 24
- vernal equinox *or* autumnal equinox
- equinox
- first day of spring *or* first day of fall

56 [1] Allow 1 credit for a response that indicates a time value of 9 a.m. Acceptable responses include, but are not limited to:

- 9:00 a.m.
- 9 o'clock in the morning
- 0900

57 [1] Allow 1 credit if *all three* student latitudes and *all three* student longitudes are correct.

**Position of Hurricane Sandy from
October 24, 2012 to October 31, 2012**

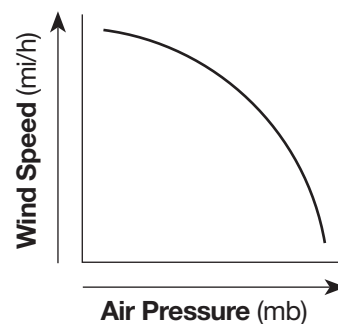
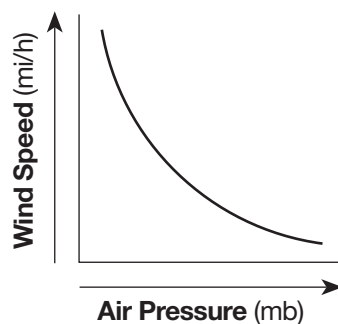
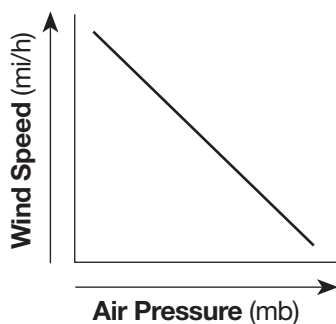
Date	Latitude°(N)	Longitude°(W)
October 24	17	77
October 25	22	76
October 26	27	77
October 27	29	76
October 28	32	73
October 29	37	71
October 30	40	78
October 31	42	80

58 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- clockwise and outward
- The winds circulate clockwise.
- The winds blow away/diverge from the center of the high.

59 [1] Allow 1 credit for a line showing that, generally, as air pressure increases, wind speed decreases.

Examples of 1-credit responses:



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

- Hurricane Sandy moved over land.
- lack of warm water to evaporate and provide energy for the hurricane
- lack of moisture to supply the hurricane energy

Note: Do *not* allow credit for “pressure increased” or “wind speed decreased” because these are a result of a hurricane moving over land, *not* a cause of the weakening of the hurricane.

61 [1] Allow 1 credit for *D* and *E*.

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

- 4600 million years ago
- 4.6×10^3 million years ago

Note: If the student crosses out million years ago, allow credit if an equivalent value is expressed in other units (e.g., 4.6 billion years ago).

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

- Oceanic oxygen began to enter the atmosphere.
- Excess oxygen in the oceans escaped into the atmosphere.
- A buildup of oxygen began.
- Photosynthetic bacteria released oxygen.

64 [1] Allow 1 credit for trilobites.

65 [1] Allow 1 credit for Precambrian *or* Archean.

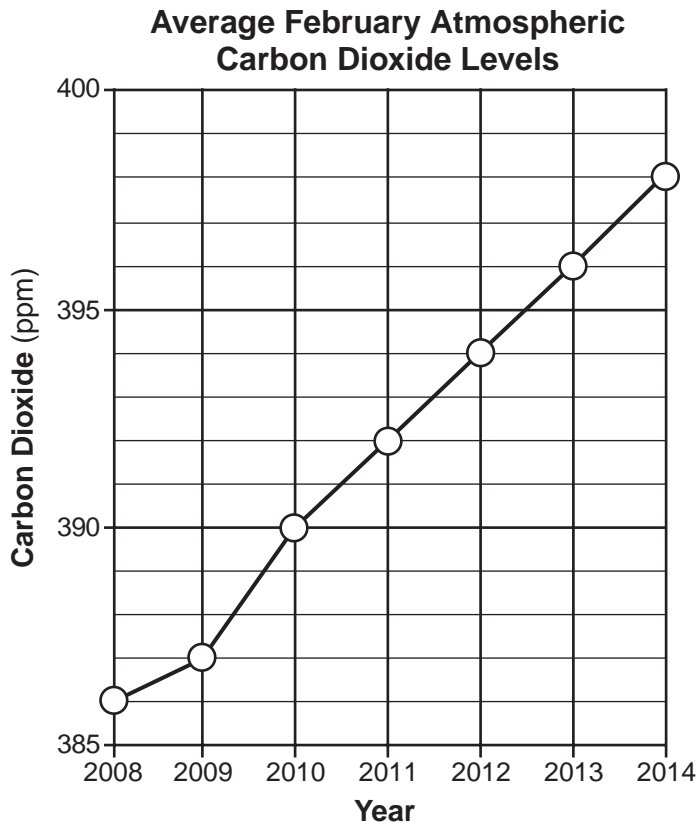
Part C

Allow a maximum of 20 credits for this part.

- 66 [1] Allow 1 credit if *all seven* plots are within or touch the circles shown and are correctly connected with a line that passes within or touches each circle.

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

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



- 67 [1] Allow 1 credit for troposphere.

- 68 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- water vapor/ H_2O
- methane/ CH_4
- nitrous oxide/ N_2O/N_xO
- ozone/ O_3
- chlorofluorocarbons/CFCs

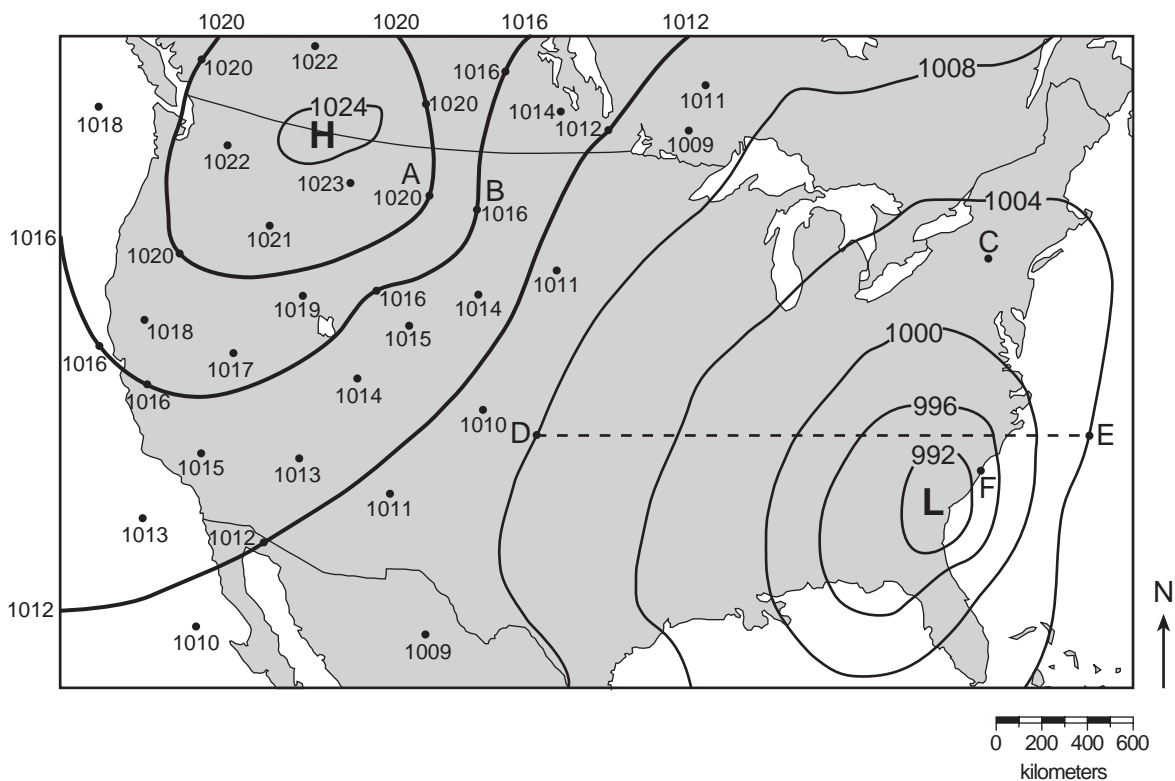
69 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- Plant more trees/reduce deforestation.
- Use public transportation/carpooling.
- Burn less fossil fuel.
- Use energy-efficient appliances/lightbulbs.
- Convert to alternative/renewable energy (e.g., solar, wind).

70 [1] Allow 1 credit if *all three* isobars are correctly drawn and the isobars extend to the edges of the map.

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

Example of a 1-credit response:



71 [1] Allow 1 credit for 30.12 in of Hg.

72 [1] Allow 1 credit for any value from 0.016 to 0.027 mb/km.

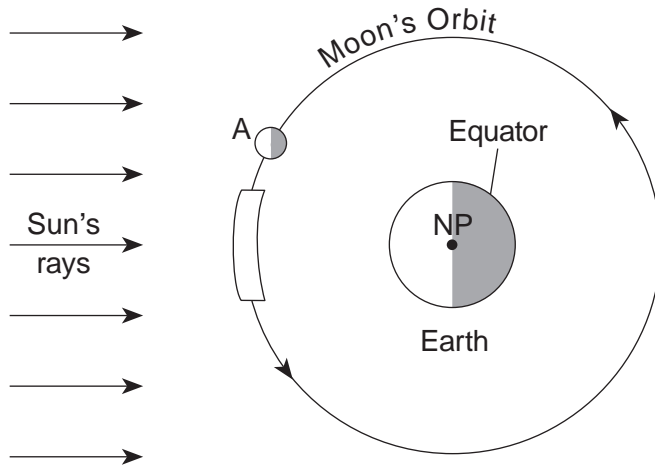
Note: Do *not* allow credit for $\frac{4}{200}$ or $\frac{1}{50}$ because this does not show a complete calculation.

73 [1] Allow 1 credit for any value greater than 988 but less than 992 mb.

74 [1] Allow 1 credit if the center of the **X** is within or touches the box on the Moon's orbit, as shown below.

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

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



(Not drawn to scale)

75 [1] Allow 1 credit for 27.3 d or $27\frac{1}{3}$ d.

76 [1] Allow 1 credit if the student shades more than half of the Moon, leaving a lighted portion on the left to indicate a crescent, as shown below.

Examples of 1-credit responses:



77 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- The Moon’s orbit has an elliptical shape.
- slightly eccentric
- almost a circle/nearly circular
- oval
- has an eccentricity of 0.055

Note: Do *not* allow credit for “circle” or “circular” alone because the eccentricity of the Moon’s orbit is not zero.

78 [1] Allow 1 credit for Erie-Ontario Lowlands, *or* Erie-Ontario Plains, *or* Interior Lowlands.

79 [1] Allow 1 credit for dolomite *or* $\text{CaMg}(\text{CO}_3)_2$.

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

- North America was located on/near the equator.
- North America was located at a lower latitude.
- It was farther south.
- mostly in the Southern Hemisphere
- farther east
- southeast

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

- the collision between North America and a volcanic island arc
- closing of the western part of the Iapetus Ocean
- crustal uplift
- convergence

82 [1] Allow 1 credit for quartz.

83 [1] Allow 1 credit for placing only *four* **X**s in the correct columns, as shown below.

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

Mineral Name	Felsic	Mafic
Potassium feldspar	X	
Olivine		X
Quartz	X	
Pyroxene		X

84 [1] Allow 1 credit for *both* oxygen (O) *and* silicon (Si).

85 [1] Allow 1 credit for *both* olivine *and* quartz.

Regents Examination in Physical Setting/Earth Science

January 2017

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

The Chart for Determining the Final Examination Score for the January 2017 Regents Examination in Physical Setting/Earth Science will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Thursday, January 26, 2017. Conversion charts provided for previous administrations of the Regents Examination in Physical Setting/Earth Science must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

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

1. Go to <http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.cfm>.
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the **SUBMIT** button at the bottom of the page to submit the completed form.

Map to Core Curriculum

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

The State Education Department / The University of the State of New York
Regents Examination in Physical Setting/Earth Science – January 2017
Chart for Converting Total Test Raw Scores to Final Examination Scores (Scale Scores)
(Not to be used for the Braille Edition)

To determine the student's final score, locate the student's Total Performance Test Score across the top of the chart and the Total Written Test Score down the side of the chart. The point where the two scores intersect is the student's final examination score. For example, a student receiving a Total Performance Test Score of 10 and Total Written Test Score of 65 would receive a final examination score of 85.

		Total Performance Test Score																
		16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Total Written Test Score	85	100	99	99	99	98	98	97	96	96	95	94	93	91	90	88	87	85
	84	99	99	98	98	98	97	96	96	95	94	93	92	91	89	88	86	84
	83	99	99	98	98	98	97	96	96	95	94	93	92	91	89	88	86	84
	82	98	98	98	97	97	96	95	95	94	93	92	91	90	88	87	85	83
	81	98	98	98	97	97	96	95	95	94	93	92	91	90	88	87	85	83
	80	97	97	97	96	96	95	95	94	93	92	91	90	89	88	86	84	82
	79	97	96	96	95	95	94	94	93	92	91	90	89	88	87	85	83	82
	78	97	96	96	95	95	94	94	93	92	91	90	89	88	87	85	83	82
	77	96	95	95	95	94	94	93	92	91	91	89	88	87	86	84	83	81
	76	95	95	94	94	93	93	92	91	91	90	89	88	86	85	83	82	80
	75	95	95	94	94	93	93	92	91	91	90	89	88	86	85	83	82	80
	74	94	94	93	93	92	92	91	90	90	89	88	87	86	84	83	81	79
	73	93	93	92	92	92	91	90	90	89	88	87	86	85	83	82	80	78
	72	92	92	92	91	91	90	90	89	88	87	86	85	84	82	81	79	77
	71	92	92	92	91	91	90	90	89	88	87	86	85	84	82	81	79	77
	70	92	91	91	90	90	89	89	88	87	86	85	84	83	82	80	78	77
	69	91	90	90	89	89	88	88	87	86	85	84	83	82	81	79	77	76
	68	90	90	89	89	88	88	87	86	85	85	84	82	81	80	78	77	75
	67	89	89	88	88	87	87	86	85	85	84	83	82	80	79	77	76	74
	66	89	89	88	88	87	87	86	85	85	84	83	82	80	79	77	76	74
65	88	88	87	87	86	86	85	85	84	83	82	81	80	78	77	75	73	
64	87	87	87	86	86	85	84	84	83	82	81	80	79	77	76	74	72	
63	86	86	86	85	85	84	84	83	82	81	80	79	78	77	75	73	71	
62	86	85	85	84	84	83	83	82	81	80	79	78	77	76	74	72	71	
61	85	84	84	84	83	82	82	81	80	79	78	77	76	75	73	72	70	
60	84	84	83	83	82	82	81	80	80	79	78	77	75	74	72	71	69	
59	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	74	73	73	72	71	70	69	67	66	64	
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 2017 – continued**

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