The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Thursday, January 24, 2013 — 1:15 to 4:15 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.

P.S./EARTH SCIENCE

Part A

Answer all questions in this part.

Directions (1–35): Use your knowledge of Earth science to answer all questions. 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 Why is the surface of Mercury covered with meteor impact craters, while Earth's surface has relatively few craters?

(1) Mercury is larger than Earth, so it gets hit with more meteors.
(2) Mercury is an older planet, so it has a longer history of meteor impacts.
(3) Earth's less dense water surface attracts fewer meteors.
(4) Earth's hydrosphere and atmosphere destroyed or buried most meteor impact sites.

2 Which information best supports the inference that the universe began with an explosion?

(1) measurements of rates of decay using carbon-14
(2) measurements of cosmic background radiation
(3) calculations of the distance from the Sun to each asteroid in the asteroid belt
(4) calculations of the temperature and luminosity of stars

3 A blue shift of the light from a star indicates that the star

(1) will soon become a main sequence star
(2) will soon become a giant star
(3) is moving closer to Earth
(4) is moving away from Earth

4 Evidence that Earth revolves around the Sun is provided by the

(1) apparent rising and setting of the Sun during one day
(2) apparent rising and setting of *Polaris* during one day
(3) seasonal changes in the apparent positions of constellations
(4) hourly changes in the apparent direction of the swing of a Foucault pendulum

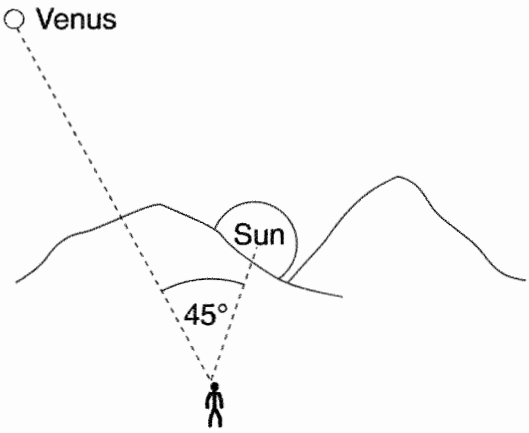
5 What causes many surface winds to deflect to the right in the Northern Hemisphere?

(1) rotation of Earth on its axis
(2) unequal heating of Earth's surface
(3) gravitational force of the Moon
(4) gravitational force of the Sun

6 During which Northern Hemisphere season is Earth closest to the Sun?

(1) spring
(2) summer
(3) autumn
(4) winter

7 An observer on Earth measures the angle of sight between Venus and the setting Sun.

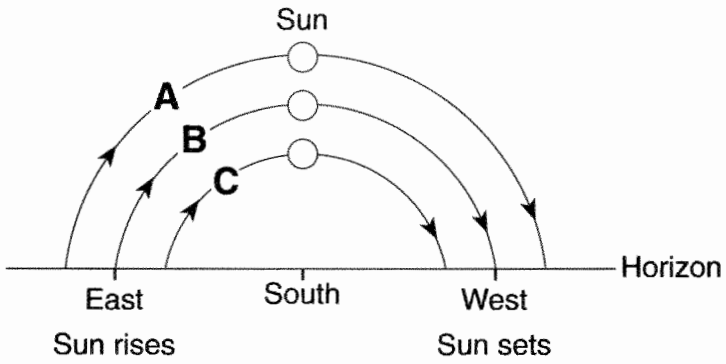


(Not drawn to scale)

Which statement best describes and explains the apparent motion of Venus over the next few hours?

(1) Venus will set 1 hour after the Sun because Earth rotates at 45° per hour.
(2) Venus will set 2 hours after the Sun because Venus orbits Earth faster than the Sun orbits Earth.
(3) Venus will set 3 hours after the Sun because Earth rotates at 15° per hour.
(4) Venus will set 4 hours after the Sun because Venus orbits Earth slower than the Sun orbits Earth.

8 The diagram below represents the horizon and the Sun's apparent paths, *A*, *B*, and *C*, on three different dates, as viewed from the same location in New York State.



Which table correctly shows the dates on which the apparent paths of the Sun were observed?

Path of Sun	Date
A	December 21
B	September 23
C	March 21

(1)

Path of Sun	Date
A	March 21
B	September 23
C	June 21

(3)

Path of Sun	Date
A	December 21
B	March 21
C	June 21

(2)

Path of Sun	Date
A	June 21
B	March 21
C	December 21

(4)

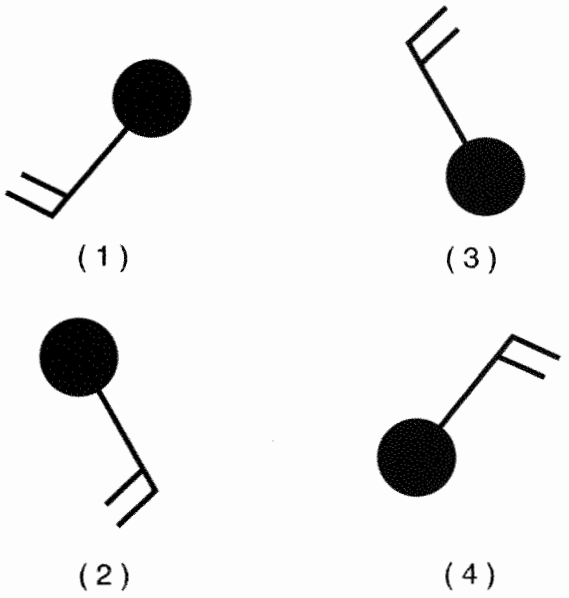
9 Scientists infer that most of Earth's earliest atmosphere was produced by

(1) a collision with a giant gas cloud
(2) capturing gases from a nearby planet
(3) vaporizing comets that impacted Earth's surface
(4) the escape of gases from Earth's molten surface

10 An increase in the transparency of Earth's atmosphere is often caused by

(1) a decrease in cloud cover
(2) a decrease in solar radiation
(3) an increase in airborne dust particles
(4) an increase in the duration of insolation

11 Which station model shows a wind direction from the southeast?



12 The direction of movement of the major surface ocean currents is most affected by Earth's

(1) tilted axis
(2) prevailing winds
(3) rate of revolution
(4) tidal action

13 The winds shift from southwest to northwest as heavy rains and hail begin to fall in Albany, New York. These changes are most likely caused by the arrival of

(1) an mT air mass
(2) a cT air mass
(3) a cold front
(4) a warm front

14 A city located on the coast of North America has warmer winters and cooler summers than a city at the same elevation and latitude located near the center of North America. Which statement best explains the difference between the climates of the two cities?

(1) Ocean surfaces change temperature more slowly than land surfaces.
(2) Warm, moist air rises when it meets cool, dry air.
(3) Wind speeds are usually greater over land than over ocean water.
(4) Water has a lower specific heat than land.

15 Most of the electromagnetic energy radiated from Earth's surface is in the form of

(1) ultraviolet rays
(2) infrared rays
(3) gamma rays
(4) x rays

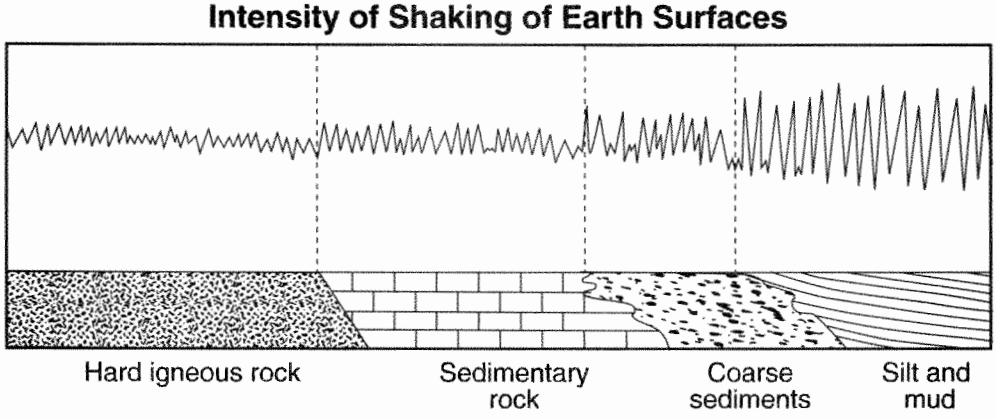
16 Which two 23.5°-latitude locations are influenced by cool surface ocean currents?

(1) the east coast of North America and the west coast of Australia
(2) the east coast of Asia and the east coast of North America
(3) the west coast of Africa and the east coast of South America
(4) the west coast of North America and the west coast of South America

17 The arrival time of the first earthquake *P*-wave at a seismograph station was 10:11:20 (hours:minutes:seconds). If the epicenter of the earthquake is 8000 km away, what was the approximate arrival time of the first *S*-wave from this earthquake?

(1) 10:02:00
(2) 10:09:20
(3) 10:20:40
(4) 10:32:00

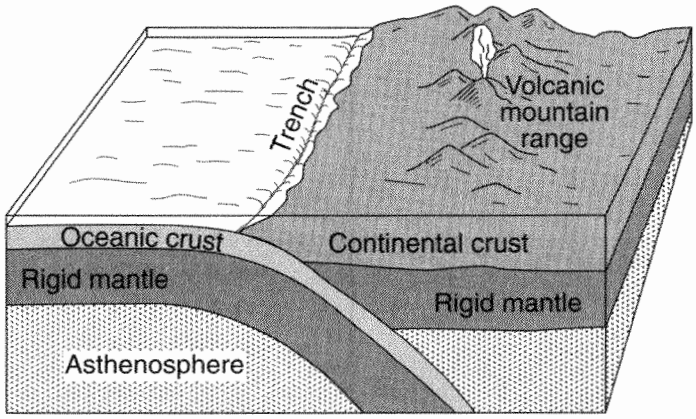
18 The diagram below represents the intensity of the shaking that occurs on different Earth surfaces during the same earthquake.



The greatest earthquake hazard to homes exists when they are built on

(1) hard igneous rock
(2) sedimentary rock
(3) coarse sediments
(4) silt and mud

Base your answers to questions 19 and 20 on the block diagram below, which shows a tectonic plate boundary.



(Not drawn to scale)

19 Which tectonic plate boundary is best represented by this diagram?

(1) Nazca Plate and Pacific Plate boundary
(2) Scotia Plate and South American Plate boundary
(3) Juan de Fuca Plate and North American Plate boundary
(4) Antarctic Plate and Indian-Australian Plate boundary

20 Compared to the oceanic crust, the continental crust is

(1) more dense and more mafic
(2) more dense and more felsic
(3) less dense and more mafic
(4) less dense and more felsic

21 Most of the sediment that is compacted and later forms shale bedrock is

(1) clay
(2) silt
(3) sand
(4) pebbles

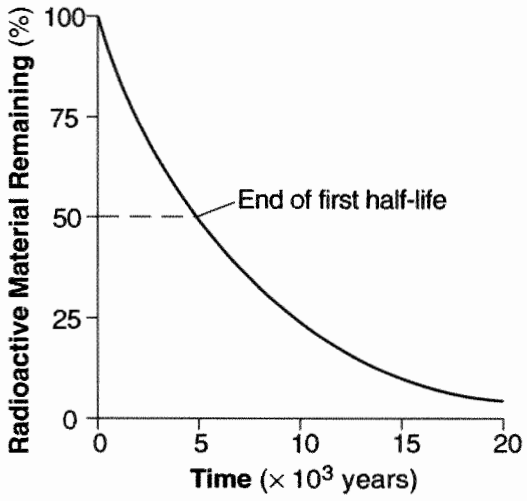
22 In which two Earth regions is oxygen the second most abundant element by volume?

(1) crust and hydrosphere
(2) hydrosphere and troposphere
(3) troposphere and core
(4) core and crust

23 Which two properties are most useful in distinguishing between galena and halite?

(1) cleavage and color
(2) luster and color
(3) hardness and streak
(4) streak and cleavage

24 The graph below shows the decay of a radioactive material over time.



How long does it take for this radioactive material to decay through 2 half-lives?

(1) 1×10^3 years
(2) 5×10^3 years
(3) 10×10^3 years
(4) 40×10^3 years

25 A 65.5-million-year-old impact crater in Mexico provides evidence for the cause of the

(1) breakup of Pangaea
(2) evolution of the earliest corals
(3) Alleghenian orogeny
(4) extinction of ammonoids

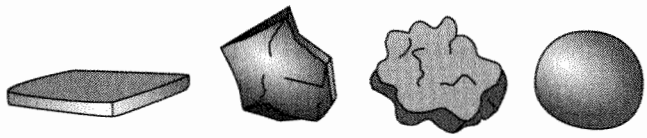
26 When did the earliest humans appear on Earth?

(1) before the earliest dinosaurs
(2) before the earliest flowering plants
(3) during the Pleistocene Epoch
(4) during the Late Triassic Epoch

27 A landslide is an example of

(1) river deposition
(2) glacial scouring
(3) mass movement
(4) chemical weathering

28 Each of the rock particles below has the same density and volume. Which particle will most likely settle at the fastest rate in moving water?



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

29 Which rock weathers most rapidly when exposed to acid rain?

(1) quartzite
(2) granite
(3) basalt
(4) limestone

30 What is the approximate minimum stream velocity needed to keep a particle in motion that has a diameter of 10 centimeters?

(1) 110 cm/s
(2) 190 cm/s
(3) 325 cm/s
(4) 425 cm/s

31 Which change is most likely to occur in a landscape if its climate changes from humid to arid?

(1) Wind will become a more important agent of erosion.
(2) Surface features will become more rounded.
(3) Chemical weathering will increase.
(4) Vegetation will increase.

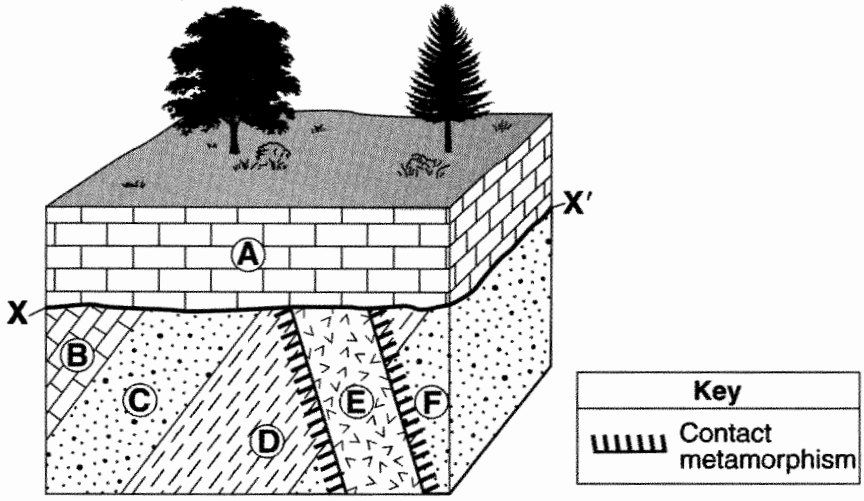
32 The surface bedrock in the Hudson Highlands consists mostly of

(1) diabase, dolostone, and granite
(2) slate, siltstone, and basalt
(3) gneiss, quartzite, and marble
(4) limestone, shale, sandstone, and conglomerate

33 The Catskills landscape region is classified as a plateau because it has

(1) low elevations and mostly faulted or folded bedrock
(2) low elevations and mostly horizontal bedrock
(3) high elevations and mostly faulted or folded bedrock
(4) high elevations and mostly horizontal bedrock

Base your answers to questions 34 and 35 on the block diagram below, which shows bedrock units *A* through *F* and boundary *XX'*.



34 The rock that formed in the contact metamorphic zone between rock unit *E* and rock unit *D* is

(1) hornfels
(2) marble
(3) schist
(4) anthracite coal

35 Which sequence best describes the geologic history, from oldest to youngest, that occurred at this site?

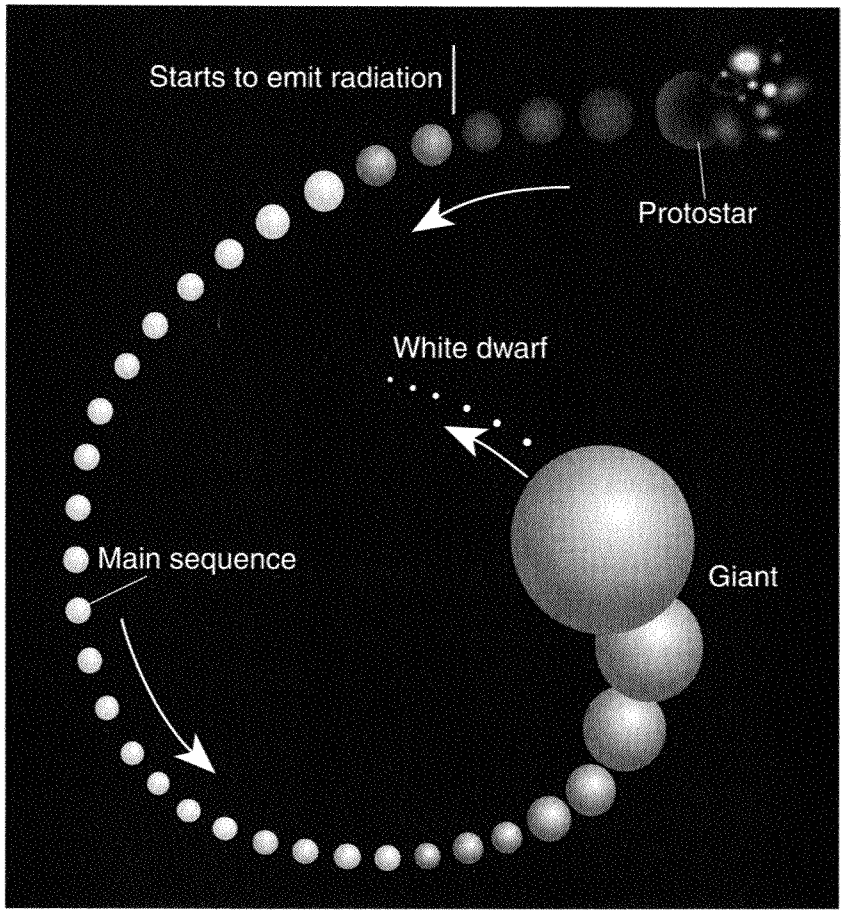
(1) deposition of *F*, *D*, *C*, *B* → intrusion of *E* → uplift and erosion → deposition of *A*
(2) intrusion of *E* → deposition of *F*, *D*, *C*, *B* → uplift and erosion → deposition of *A*
(3) deposition of *F*, *D*, *C*, *B*, *A* → uplift and erosion → intrusion of *E*
(4) deposition of *F*, *D*, *C*, *B*, *A* → intrusion of *E* → uplift and erosion

Part B–1

Answer all questions in this part.

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

Base your answers to questions 36 and 37 on the diagram below, which shows the change in the size of a star such as our Sun as it evolves from a protostar to a white dwarf star.



36 During which stage of development does the star have a cool surface temperature and the greatest luminosity?

(1) protostar
(2) main sequence
(3) giant
(4) white dwarf

37 Which process produces the energy radiated by the star when it becomes a main sequence star?

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

Base your answers to questions 38 through 40 on the passage below.

Crustal Activity at Mid-Ocean Ridges

Mid-ocean ridges are found at one type of tectonic plate boundary. These ridges consist of extensive underwater mountain ranges split by rift valleys. The rift valleys mark places where two crustal plates are pulling apart, widening the ocean basins, and allowing magma from the asthenosphere to move upward. In some cases, mid-ocean ridges have migrated toward nearby mantle hot spots. This explains why mid-ocean ridges and mantle hot spots are found together at several locations.

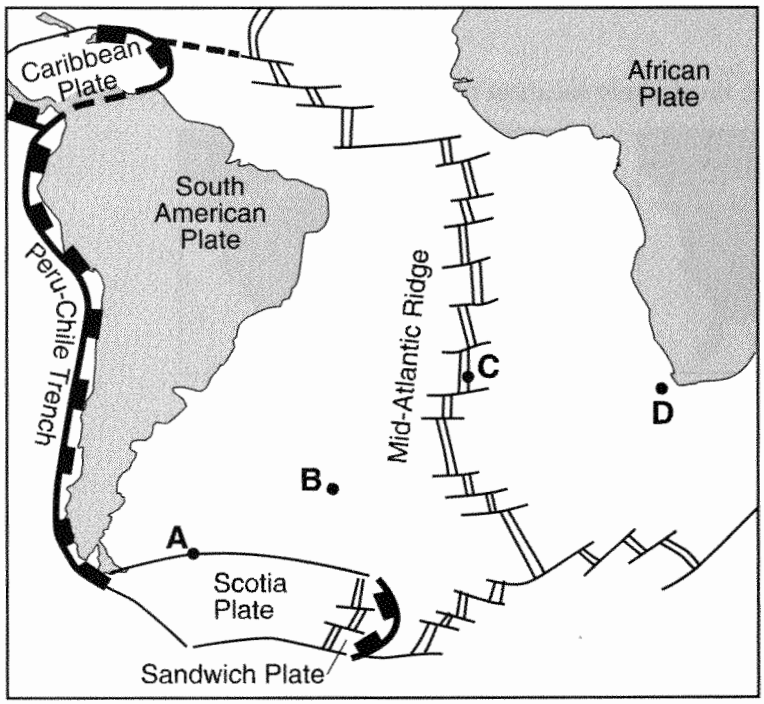
38 Which type of tectonic plate boundary is located at mid-ocean ridges?

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

39 Which mantle hot spot is located closest to a mid-ocean ridge?

(1) Canary Islands
(2) Easter Island
(3) Hawaii
(4) Tasman

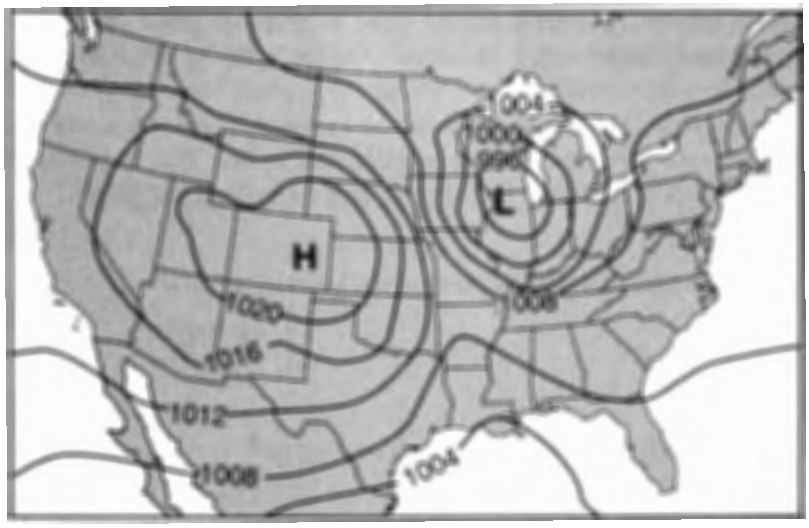
40 The map below shows a part of Earth's surface. Points *A* through *D* are locations on the ocean floor.



At which location is the temperature of the ocean floor bedrock most likely highest?

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

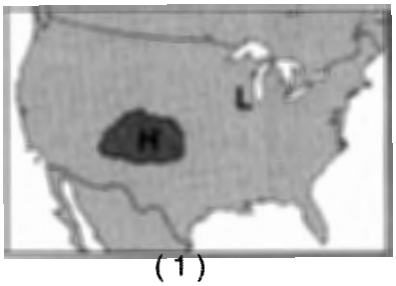
Base your answers to questions 41 through 44 on the weather map below, which shows the locations of a high-pressure center (**H**) and a low-pressure center (**L**) over a portion of North America. The isolines indicate surface air pressures.



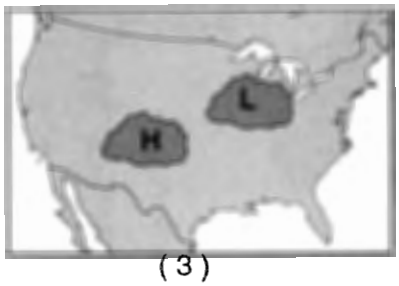
41 The data used to construct the isolines on this map were recorded in which units?

(1) inches
(2) millibars
(3) feet
(4) meters

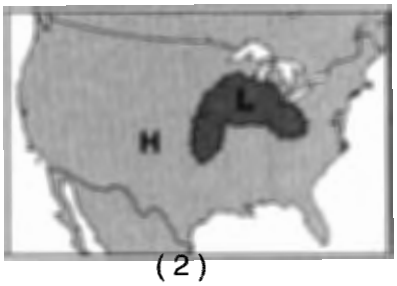
42 Which map shows the most likely location of clouds associated with these pressure centers?



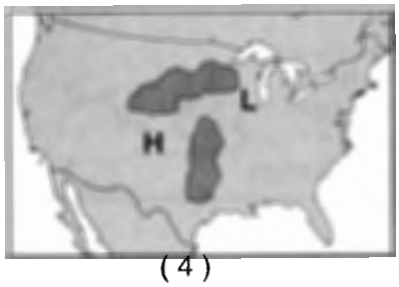
(1)



(3)

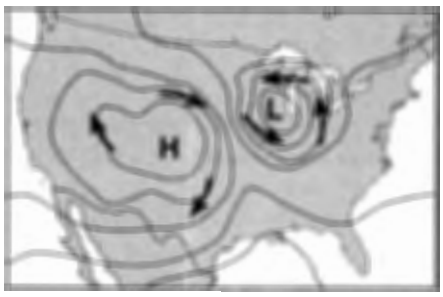


(2)

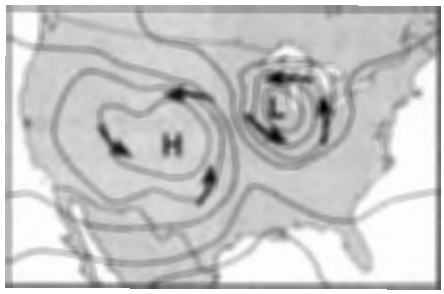


(4)

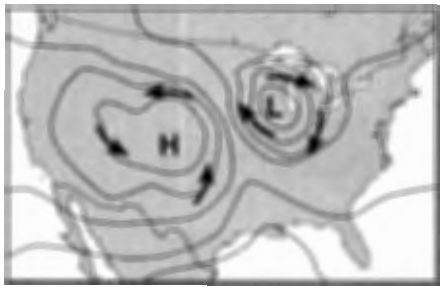
43 The arrows on which map best show the pattern of surface winds around these two pressure centers?



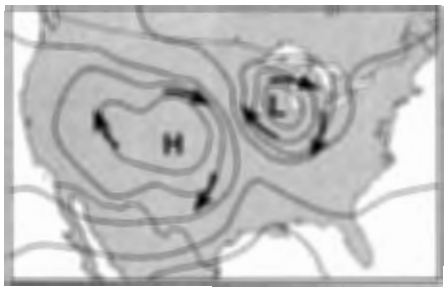
(1)



(3)

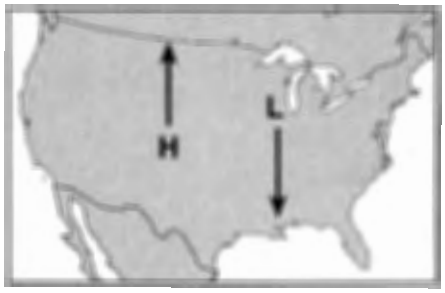


(2)

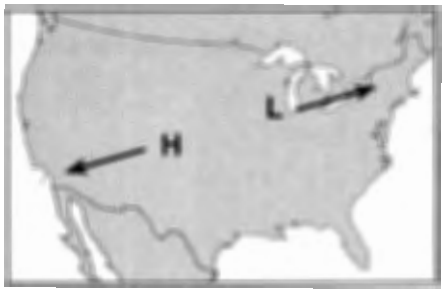


(4)

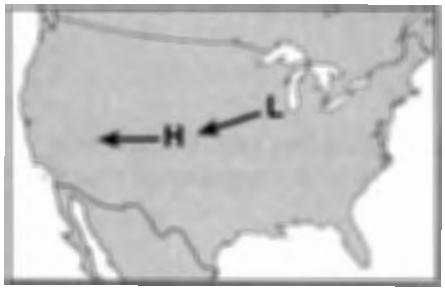
44 The arrows on which map show the most likely path in which these two pressure centers will move over the next few days?



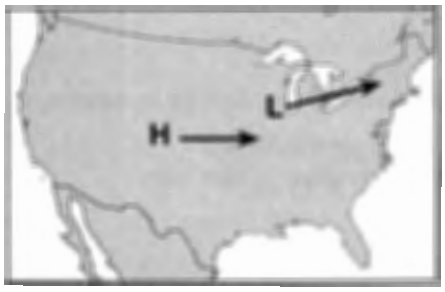
(1)



(3)



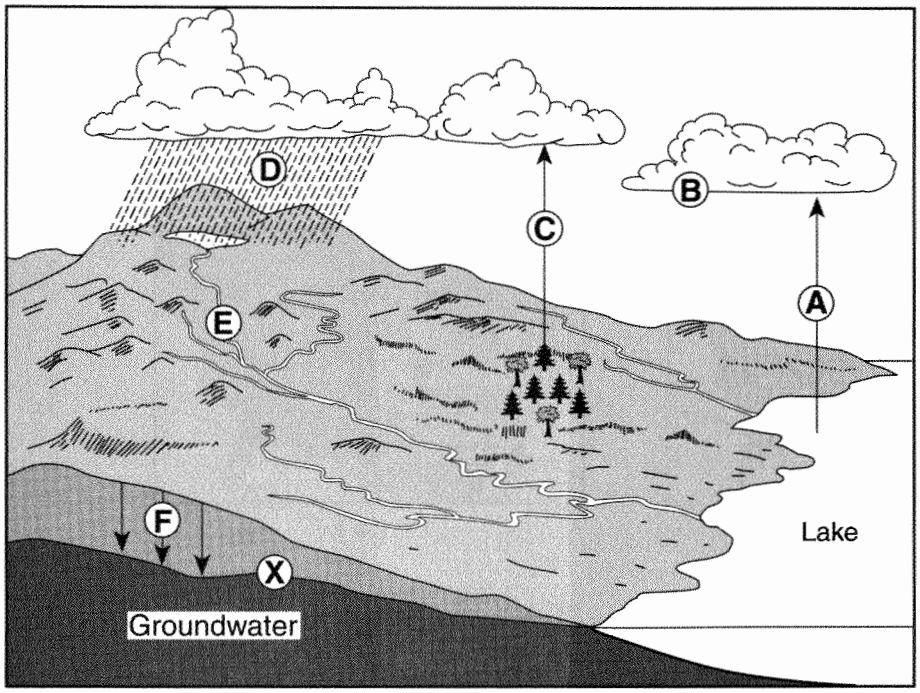
(2)



(4)

Base your answers to questions 45 through 48 on the diagram below, which shows a model of the water cycle. Letters *A* through *F* represent some processes of the water cycle. Letter *X* indicates the top of the underground zone that is saturated with water.

The Water Cycle



(Not drawn to scale)

45 Which process is represented by letter *F*?

(1) capillarity
(2) infiltration
(3) condensation
(4) vaporization

46 What does letter *X* represent?

(1) the water table
(2) a floodplain
(3) sea level
(4) impermeable rock

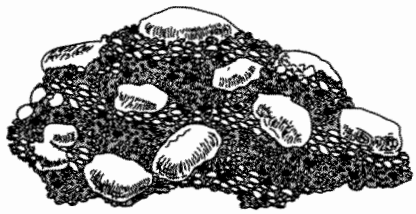
47 If the surface soil is saturated and precipitation increases, there will be

(1) a decrease in the amount of groundwater
(2) a decrease in the surface elevation of the lake
(3) an increase in the rate of capillarity
(4) an increase in the amount of runoff

48 The processes of transpiration and evaporation are represented by letters

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

Base your answers to questions 49 and 50 on the diagram below, which represents a rock composed of cemented pebbles and sand.



49 This rock should be classified as

(1) an intrusive igneous rock
(2) an extrusive igneous rock
(3) a bioclastic sedimentary rock
(4) a clastic sedimentary rock

50 Which change would most likely occur if this rock became buried deep within Earth's crust and was subjected to intense heat and pressure, but did *not* melt?

(1) The density of the pebbles and sand would decrease.
(2) The rock would become a plutonic rock composed mostly of quartz.
(3) The rock would become more felsic with a higher concentration of magnesium.
(4) The pebbles would become distorted and the sand would be recrystallized.

Part B–2

Answer all questions in this part.

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

Base your answers to questions 51 through 53 on the diagram in your answer booklet, which shows Earth as viewed from space on December 21. Some latitudes are labeled.

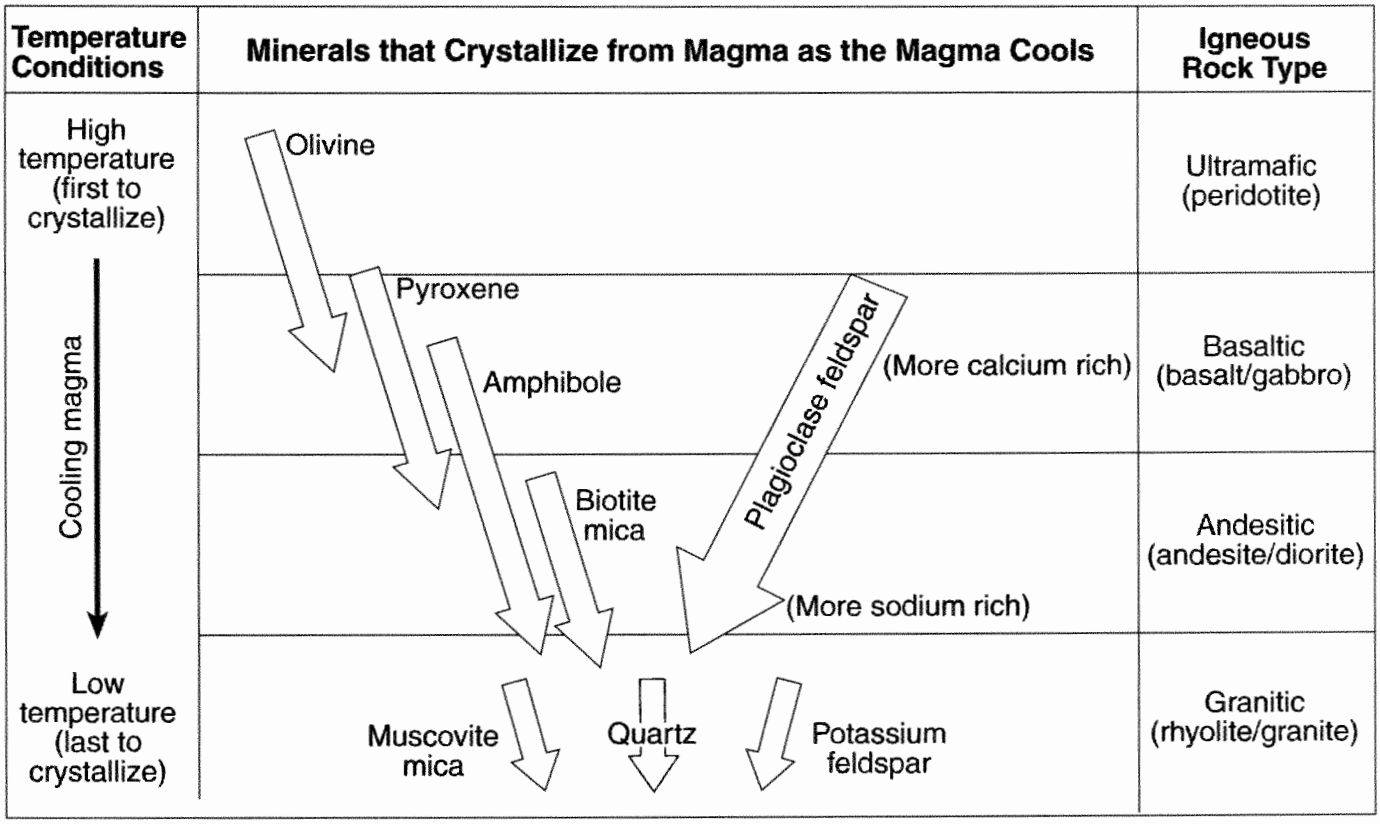
51 On the diagram *in your answer booklet*, place an **X** at a location on Earth's surface where the Sun was directly overhead at some time on December 21. [1]

52 State *one* factor, other than the tilt of Earth's axis, that causes seasons to change on Earth. [1]

53 At which latitude is *Polaris* observed at an altitude of 66.5°? [1]

Base your answers to questions 54 through 56 on the diagram of Bowen's Reaction Series below, which shows the sequence in which minerals crystallize as magma cools and forms different types of igneous rocks from the same magma. The arrow for each mineral represents the relative temperature range at which that mineral crystallizes.

Bowen's Reaction Series



54 According to Bowen's Reaction Series, how is the chemical composition of plagioclase feldspar found in basaltic rock different from the chemical composition of plagioclase feldspar found in granitic rock? [1]

55 Describe the temperature conditions shown in Bowen's Reaction Series that explain why olivine and quartz are *not* usually found in the same igneous rock type. [1]

56 Identify *one* similarity and *one* difference between the igneous rocks andesite and diorite. [1]

Base your answers to questions 57 through 61 on the diagram and tables below. The diagram shows a rock sample containing fossils from a location in New York State at 42° N 78° 15′ W. Fossils 1, 2, 3, and 4 are labeled. Table *A* lists the names and rock types of the New York State rock units from the Middle and Late Devonian in this area. The presence of fossil 1, 2, 3, or 4 in a rock unit is indicated by an **X** in the fossils column in the table. Table *B* identifies typical rocks formed within different marine (ocean) environments.

Rock Sample

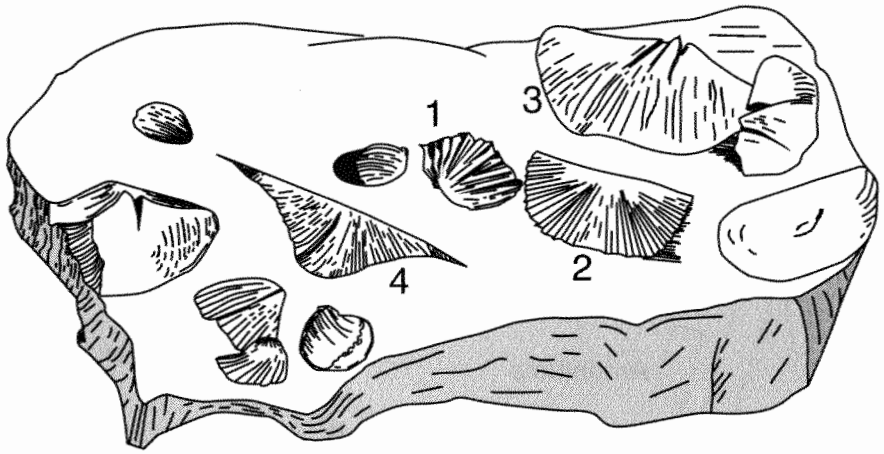


Table A: New York State Rock Units in Area Where the Rock Sample was Found

Geologic Age: Devonian	Name of Rock Unit	Type of Rock Found in Unit	Fossils			
			1	2	3	4
Late	Conewango	shales and sandstones	X	X		X
Late	Conneaut	shales and sandstones	X	X		X
Late	Canadaway	shales and sandstones	X	X	X	X
Late	West Falls	shales and sandstones	X	X	X	
Late	Sonyea	shale	X	X	X	
Late/Middle	Genesee	shale	X	X		
Middle	Tully	limestone	X	X		
Middle	Hamilton	limestone	X	X		
Middle	Onondaga	limestone (includes volcanic ash bed)		X		

Table B: Sedimentary Rock Types Formed in Different Marine Environments

Sedimentary Rocks	Marine Environment
limestones	clear, shallow water
gray shales	muddy, oxygen rich
black shales	muddy, oxygen poor
siltstones and sandstones	silty to sandy bottom
evaporites	very salty, shallow seas
coarse-grained sandstones and conglomerates	tidal shores and deltas

57 On the map *in your answer booklet*, place an **X** at the location where this rock sample was collected. [1]

58 Based on the fossils present, the rock sample shown in the diagram came from which rock unit listed in table *A*? [1]

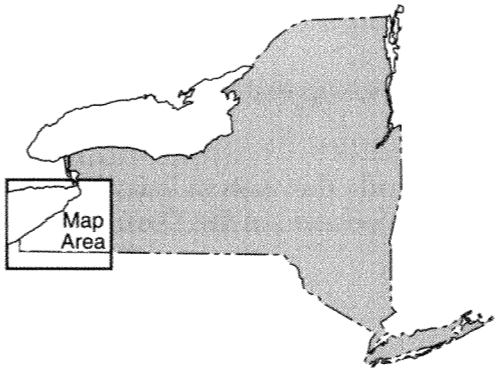
59 Identify the New York State index fossil group that includes fossil 4 shown on the rock sample. [1]

60 Identify the landmass that collided with the eastern coast of North America to create the Acadian mountain range and the basin for the deposition of the Devonian rock units in table *A*. [1]

61 According to the tables, in which marine environment was the Tully rock unit deposited? [1]

_____

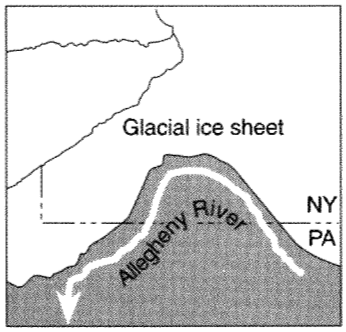
Base your answers to questions 62 through 65 on the maps below. The southwest corner of the New York State map below is enlarged in maps I, II, and III. Arrows on maps I, II, and III show the location and direction of flow for part of the Allegheny River at different times during the Cenozoic Era. The present boundaries of New York State and Lake Erie are shown on each map. Point *A* on map III represents a location in New York State.



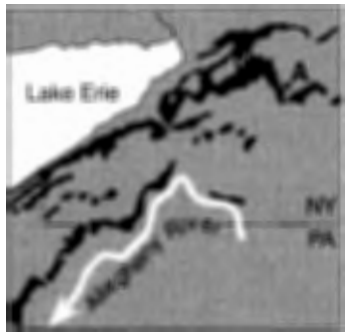
Course of the Allegheny River

Map I
During the Neogene Period

Map II
22,000 Years Ago



Map III
Present Day



Key
Glacial moraine

62 Map II shows the course of the Allegheny River during a specific part of a geologic time period. State the name of this geologic time period. [1]

63 Explain why the direction of flow of the Allegheny River changed between the times shown on map I and map II. [1]

64 Identify the present-day feature that prevents the Allegheny River from returning to its earlier (Neogene) direction of flow to the northwest. [1]

65 The diagram *in your answer booklet* shows a partial cross section of a valley near location *A* on map III. On this diagram, draw a line beginning at *X* and ending at *Y* to show the shape of this valley after it was eroded by glacial ice that flowed down the valley. [1]

Part C

Answer all questions in this part.

Directions (66–85): Use your knowledge of Earth science to answer all questions. 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 data table below, which shows the average carbon dioxide (CO_2) concentrations in Earth's atmosphere for specific years from 1930 to 2010. Carbon dioxide is a greenhouse gas in Earth's atmosphere that contributes to global warming. The average carbon dioxide concentrations were measured in parts per million (ppm).

Average Carbon Dioxide Concentrations in Earth's Atmosphere

Year	Average CO_2 Concentration (ppm)
1930	306
1940	308
1950	310
1960	316
1970	326
1980	338
1990	354
2000	370
2010	390

66 On the grid *in your answer booklet*, construct a line graph by plotting the average carbon dioxide concentrations in Earth's atmosphere for *each* year shown on the data table. Connect the plots with a line. [1]

67 Calculate the rate of change from 2000 to 2010 of the average carbon dioxide concentrations, in parts per million per year. [1]

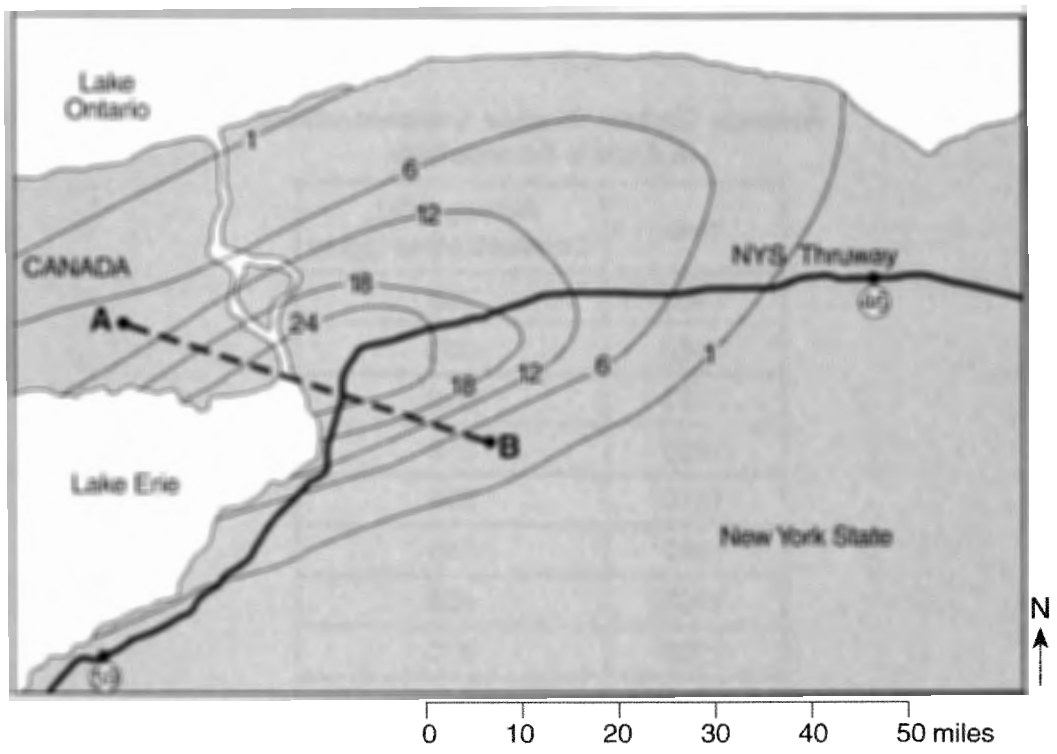
68 Identify *one* greenhouse gas, other than carbon dioxide, that contributes to global warming. [1]

_____

Base your answers to questions 69 through 73 on the map and passage below.

A Lake-Effect Snowstorm

A snowstorm affected western New York State on October 12 and 13, 2006. A blend of weather conditions caused more than 24 inches of heavy, wet, lake-effect snow, bringing much of western New York to a standstill. The New York State Thruway was closed to traffic between exits 46 and 59, which are circled on the map. The isolines on the map show the amount of snowfall, measured in inches, resulting from this storm. Points *A* and *B* represent locations on Earth's surface.



69 On the grid *in your answer booklet*, construct a profile of the snowfall amounts along line *AB* by plotting the isoline amounts that cross line *AB*. The amounts for points *A* and *B* have been plotted. Complete the profile by connecting *all* the plots with a line. [1]

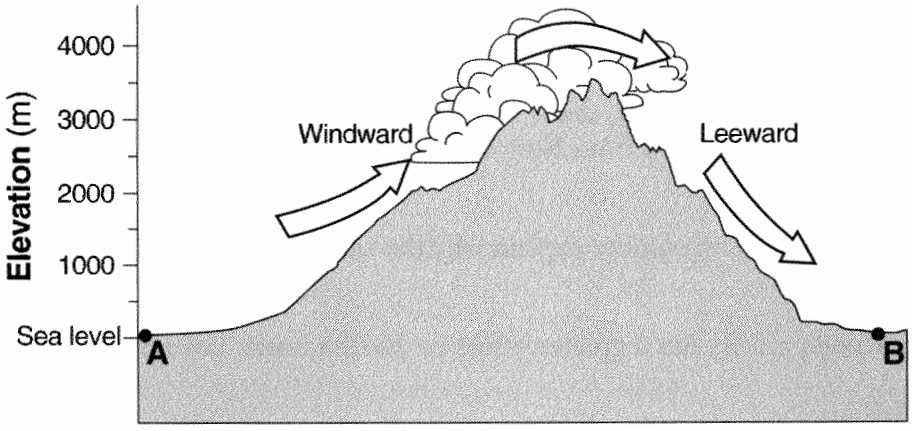
70 Approximately how many miles of this section of the Thruway were closed due to the snowstorm? [1]

71 Determine the number of inches of snow that was received in Niagara Falls, New York, from this snowstorm. [1]

72 Identify the most probable direction from which the wind was blowing to produce the pattern of snowfall shown on the map. [1]

73 Identify *two* hazards to human life or property that can result from a snowstorm of this size. [1]

Base your answers to questions 74 through 77 on the diagram below, which shows the windward and leeward sides of a mountain range. Arrows show the movement of air over a mountain. Points *A* and *B* represent locations at sea level on Earth's surface.



74 Identify *one* weather instrument that could be used to determine the dewpoint of the air at point *A*. [1]

75 What is the relative humidity at the base (bottom) of the cloud on the windward side of the mountain? [1]

76 Explain why air cools as it rises up this mountain. [1]

77 Compared to the temperature and relative humidity of the air at point *A*, describe how the temperature and relative humidity of the air are different as the air arrives at point *B*. [1]

_____

Base your answers to questions 78 through 82 on the diagram in your answer booklet, which represents eight positions of the Moon in its orbit around Earth.

78 On the diagram *in your answer booklet*, circle the position of the Moon where a solar eclipse is possible. [1]

79 On the diagram *in your answer booklet*, shade the portion of the Moon that is in darkness to show the phase of the Moon at position 3, as viewed from New York State. [1]

80 Using the terms *rotation* and *revolution*, explain why the same side of the Moon always faces Earth. [1]

81 Explain why the Moon's gravity has a greater effect on Earth's ocean tides than the Sun's gravity. [1]

82 The table below shows times of ocean tides on March 4 for a city on the Atlantic coast of the United States.

Ocean Tides on March 4

Tide	Time
high	12:00 a.m.
low	6:13 a.m.
high	12:26 p.m.

Determine the time when the next low tide occurred. Include a.m. or p.m. in your answer, if needed. [1]

Base your answers to questions 83 through 85 on the passage and data table below, which describe the exploration and characteristics of one of Saturn's moons, Titan.

Huygens Probe Lands on Titan

The Huygens probe was carried to Saturn by the Cassini spacecraft and parachuted to the surface of Saturn's giant moon, Titan. The Huygens probe's landing site was littered with smooth, rounded, rocklike objects. Photographs taken of Titan's surface show drainage channels leading to an apparent shoreline. The question is, what are they draining? One of the photographs seems to show ground fog consisting not of water, but perhaps of ethane or methane.

Titan Data

Distance from Saturn	1.22 million km
Diameter	5150 km
Average Density	1.881 g/cm^3
Atmospheric Pressure at Surface	1500 mb
Mass (Earth = 1)	0.022
Air Temperature at Landing Site	–291°F

83 What natural process occurring on Earth produces smooth, rounded rocks similar to those found at the probe's landing site on Titan? [1]

84 Approximately how many times farther is Titan from Saturn than Earth's Moon is from Earth? [1]

85 Identify the planet with a density closest to the density of Titan. [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

Thursday, January 24, 2013 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

☐ Male

Student ..... Sex: ☐ Female

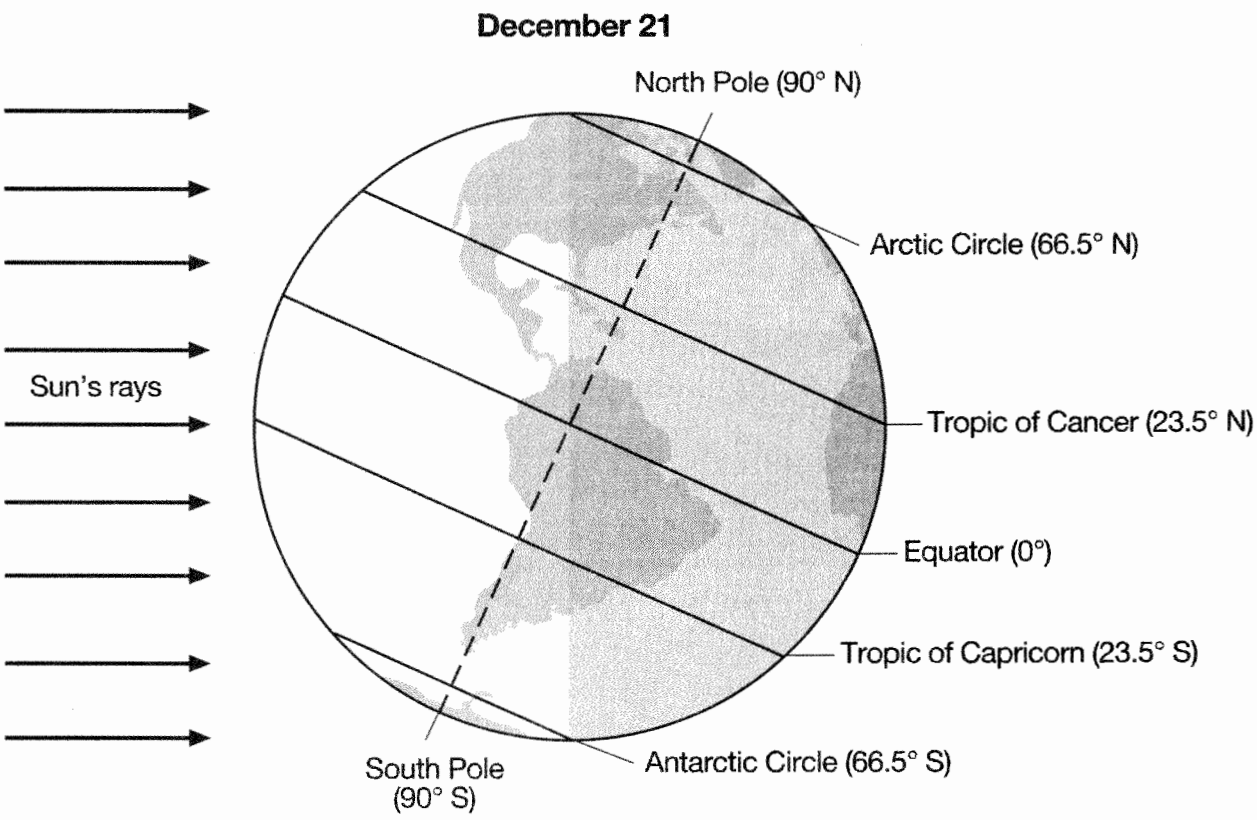
Teacher .....

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

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

Part B–2

51



(Not drawn to scale)

52 _____

53 _____

54 _____

_____

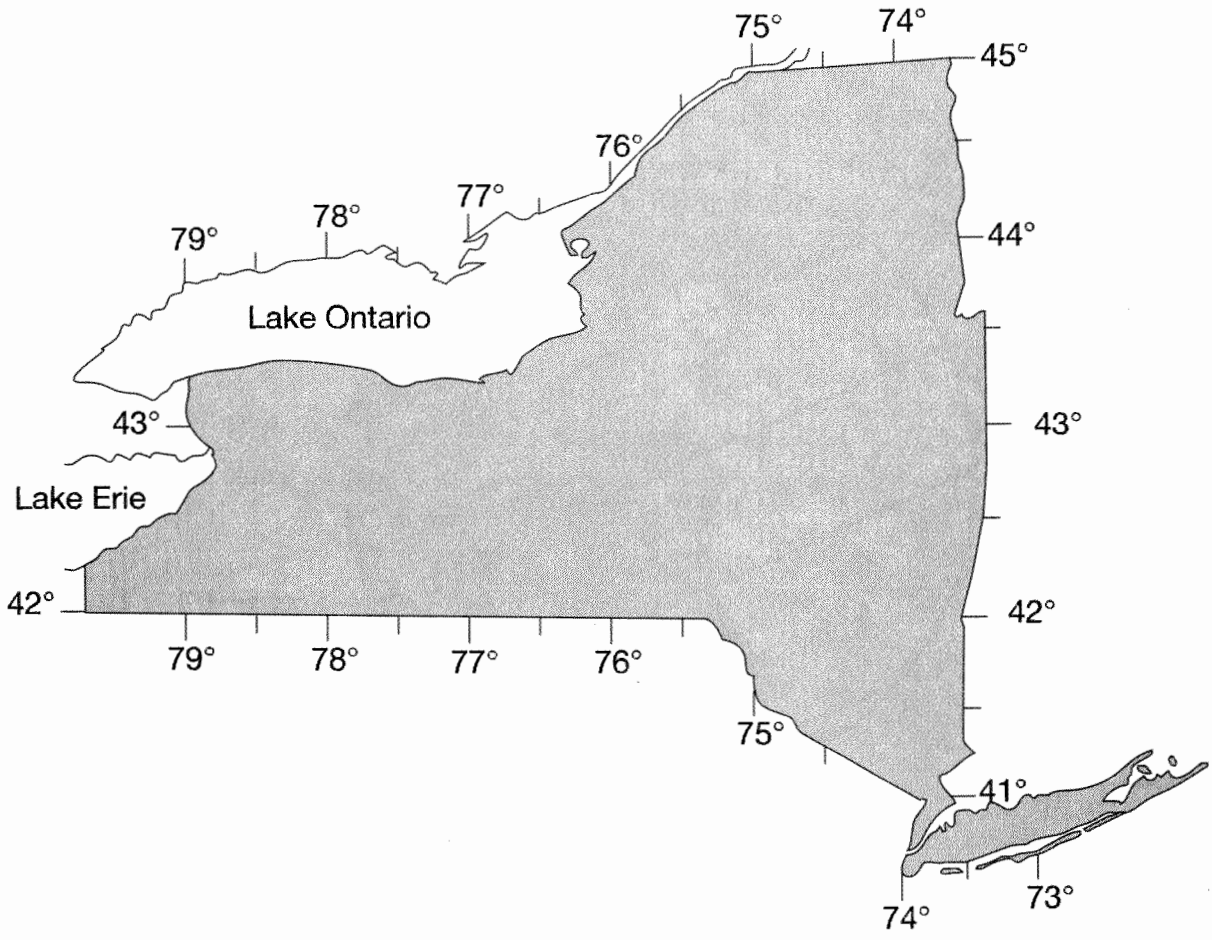
55 _____

_____

56 Similarity: _____

Difference: _____

57



58 Rock unit: _____

59 _____

60 _____

61 _____

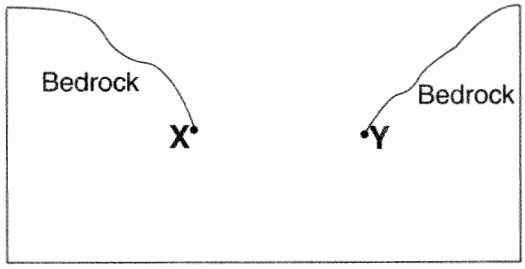
62 _____ **Period**

63 _____

_____

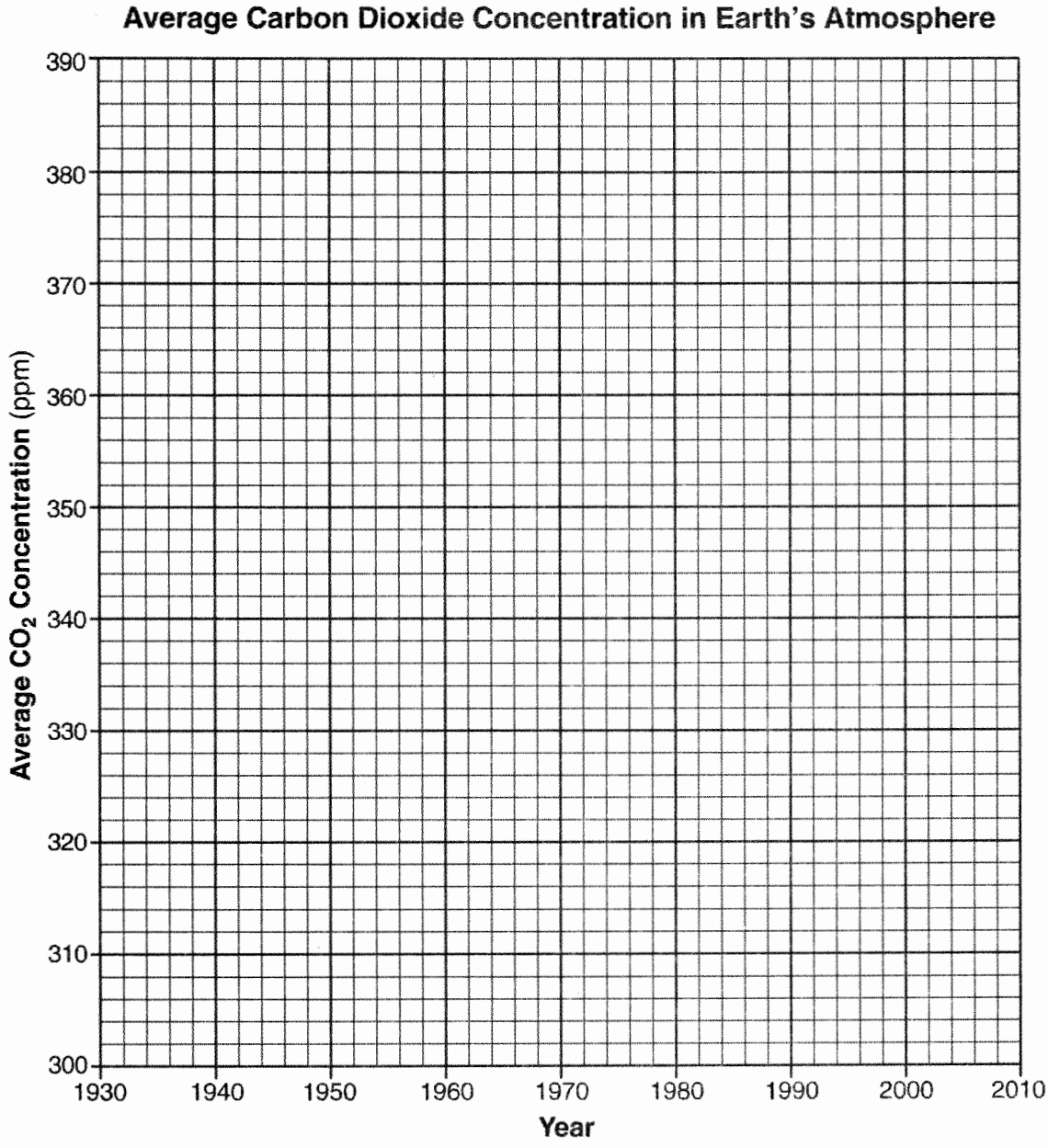
64 _____

65



Part C

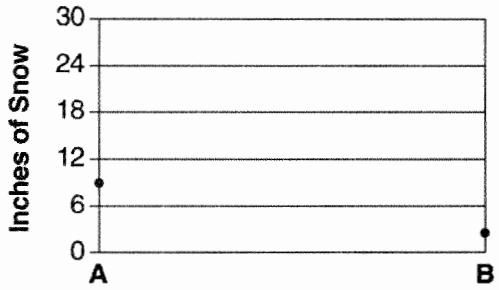
66



67 _____ ppm/y

68 _____

69



70 _____ **mi**

71 _____ **in**

72 From the: _____

73 Hazard 1: _____

Hazard 2: _____

74 _____

75 _____ **%**

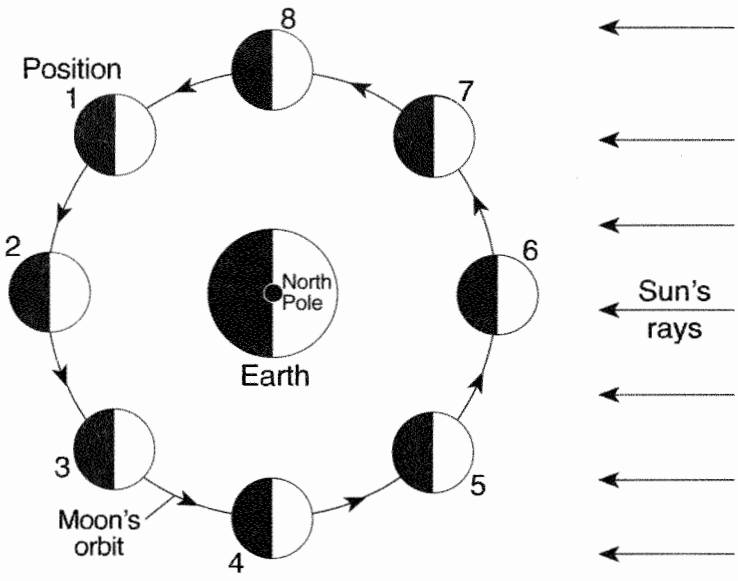
76 _____

_____

77 Temperature at *B*: _____

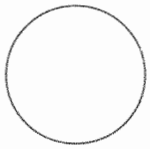
Relative humidity at *B*: _____

78



(Not drawn to scale)

79



80 _____

_____

81 _____

_____

82 _____

FOR TEACHERS ONLY

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

PS–ES PHYSICAL SETTING/EARTH SCIENCE

Thursday, January 24, 2013 — 1:15 to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: http://www.p12.nysed.gov/assessment/ and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Part A and Part B–1
Allow 1 credit for each correct response.

Part A

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

Part B–1

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

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 24, 2013. 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.

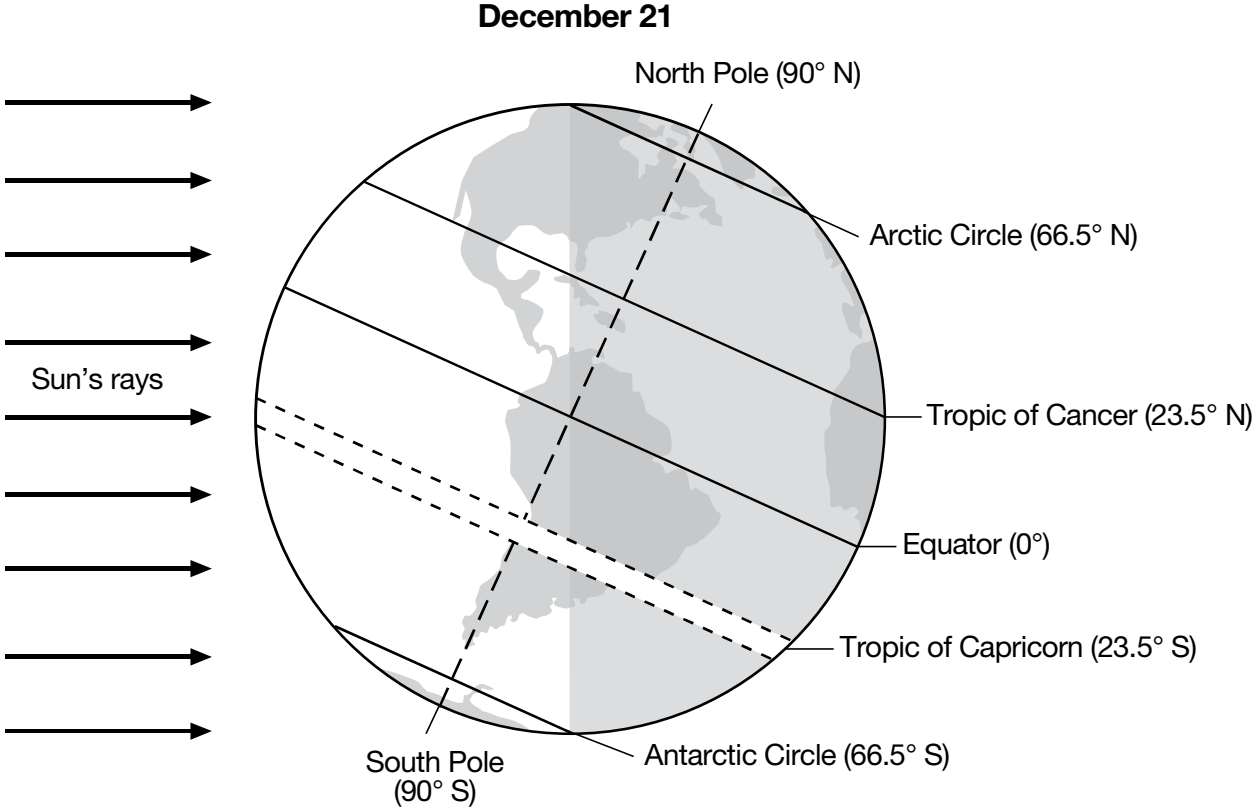
Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score.

Part B–2

Allow a maximum of 15 credits for this part.

51 [1] Allow 1 credit if the center of the **X** is located within the area between the dashed lines on either side of the Tropic of Capricorn (23.5° S).

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



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

— parallelism of Earth's axis

— The North Pole always points toward *Polaris*.

— revolution of Earth

— location of the Sun's vertical ray

— duration/intensity of insolation

— angle of insolation

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

— 66.5° N *or* $66\frac{1}{2}$° N *or* 66° 30' N

— at the Arctic Circle

Note: Units and a compass direction must be included if a numerical latitude is given.

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

— The plagioclase feldspar in the basaltic rock is more calcium rich.

— The plagioclase feldspar in the granitic rock contains more sodium.

— less sodium in basaltic plagioclase feldspar

— The basaltic rock is more calcium rich.

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

— The minerals crystallize at different temperatures.

— Olivine is the first to crystallize and quartz is the last.

— Quartz crystallizes at a lower temperature than olivine.

— Olivine forms at a higher temperature.

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

Similarity:

— Both form at lower temperatures.

— The rocks have similar mineral compositions.

— The minerals have similar densities.

— similar color

Difference:

— Andesite is extrusive and diorite is intrusive.

— Andesite has a finer texture.

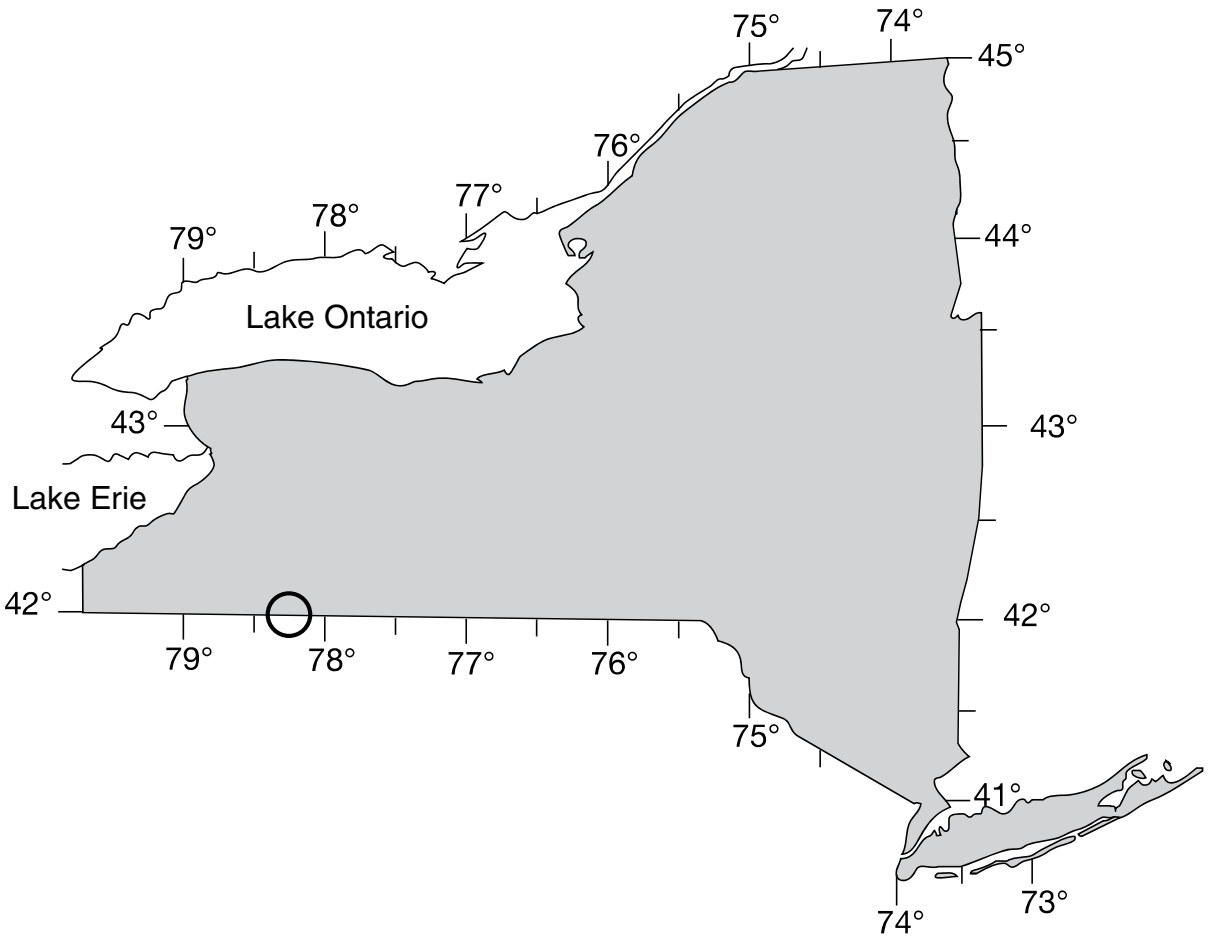
— crystal size/grain size

— cooling rates

— environment of formation

57 [1] Allow 1 credit if the center of an **X** is placed within the circled area shown on the map below.

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



58 [1] Allow 1 credit for the rock unit Canadaway.

59 [1] Allow 1 credit for brachiopods *or Mucrospirifer*.

60 [1] Allow 1 credit for Avalon.

61 [1] Allow 1 credit for clear, shallow water.

62 [1] Allow 1 credit for Quaternary Period.

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

— The glacier blocked the previous Allegheny River.

— Ice covered the original river channel.

— Glacial moraine diverted the river's path.

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

— glacial deposits

— moraines

— ridges of glacial sediments

65 [1] Allow 1 credit for a student-drawn line that is U-shaped.

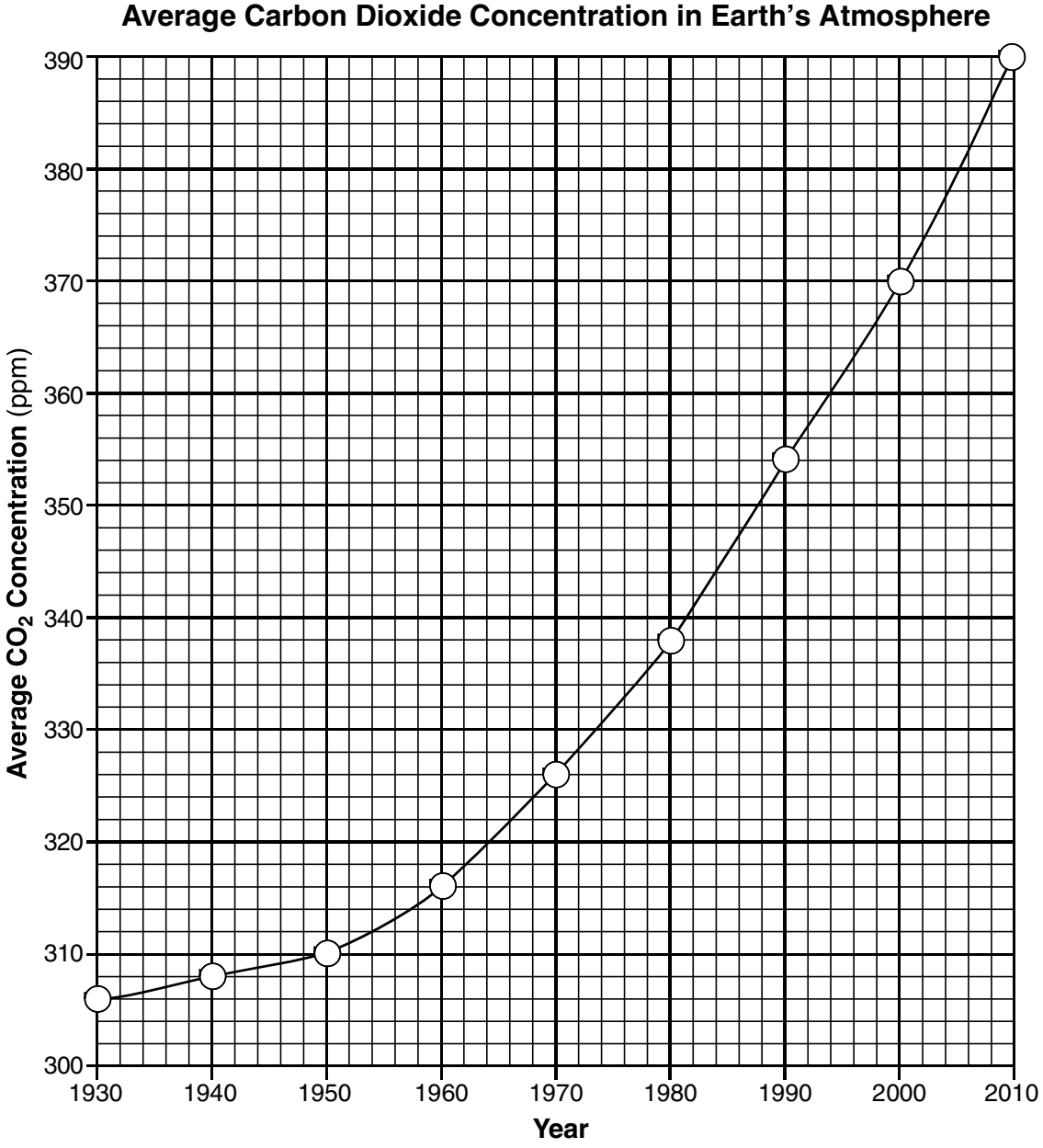
Example of a 1-credit response:

Part C

Allow a maximum of 20 credits for this part.

66 [1] Allow 1 credit if *all nine* plots are within the circles shown below and are connected with a line that passes within the circles.

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



67 [1] Allow 1 credit for 2 ppm/y.

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

— methane *or* CH_4

— water vapor *or* H_2O

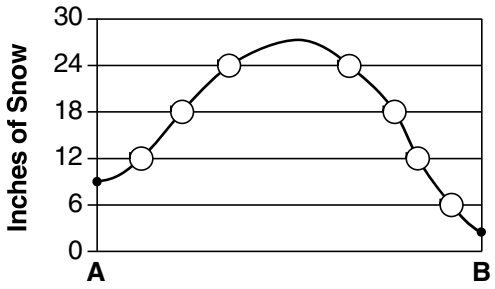
— nitrous oxide *or* N_2O

— ozone *or* O_3

— chlorofluorocarbons/CFCs

69 [1] Allow 1 credit if *all seven* student plots are within the circles shown below and are connected with a line from *A* to *B* that passes within the circles. The line must extend above 24 inches and below 30 inches.

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



70 [1] Allow 1 credit for any value from 93 mi to 107 mi.

71 [1] Allow 1 credit for any value greater than 1 in, but less than 6 in.

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

— southwest

— SW

— west southwest

— WSW

73 [1] Allow 1 credit for *two* acceptable responses. Acceptable responses include, but are not limited to:

— car accidents

— power outages

— damage to homes

— flooding

— trees falling on electrical lines/houses/cars

— heart attack from shoveling

— carbon monoxide poisoning

— no heat in the building

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

— psychrometer

— wet- and dry-bulb thermometer

— hygrometer

75 [1] Allow 1 credit for 100%.

76 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Air expands as it moves up the mountain.

— The molecules move farther apart as the air rises.

— Lower pressure at higher altitudes allows molecules to move farther apart.

— The less dense air at higher altitudes allows the air molecules to spread out.

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

Air temperature at *B*:

— warmer

— higher

— increased

Relative humidity at *B*:

— lower

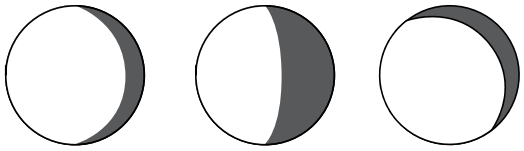
— drier

— decreased

78 [1] Allow 1 credit for circling only position 6.

79 [1] Allow 1 credit for a gibbous Moon, shaded generally on the right side of the diagram. The shaded area must be less than half of the circle.

Examples of 1-credit responses:



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

— The Moon's period of rotation equals its period of revolution.

— The Moon rotates and revolves once in 27.3 days.

— The Moon rotates and revolves at the same rate.

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

— The Moon is closer to Earth so gravity is greater.

— The Sun is much farther away.

82 [1] Allow 1 credit for any time from 6:33 p.m. to 6:45 p.m. *or* any military time from 18:33 to 18:45.

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

— weathering and/or erosion

— rock abrasion

— transport by running water

— wave action

84 [1] Allow 1 credit for any value from 3.0 to 3.2 times farther.

85 [1] Allow 1 credit for Neptune.

Regents Examination in Physical Setting/Earth Science

January 2013

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

The *Chart for Determining the Final Examination Score for the January 2013 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 24, 2013. 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 2013 Physical Setting/Earth Science			
Question Numbers			
Key Ideas/Performance Indicators	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	17, 24, 30		66, 67, 84, 85
Math Key Idea 2	7		82
Math Key Idea 3		61	71, 78, 79, 81
Science Inquiry Key Idea 1	3, 4, 8	37, 40, 52, 53	78
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3	23, 25	38, 39, 49	68, 75
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Key Idea 3			
Standard 6			
Key Idea 1	12	44, 50, 61	80, 81
Key Idea 2	8, 11, 15, 18, 19, 20, 28, 34, 35	36, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 51, 54, 55, 56, 57, 58, 60, 63, 64, 65	69, 72, 76, 77, 78, 79, 82
Key Idea 3			70
Key Idea 4			
Key Idea 5	6, 13, 35	44, 50, 65	72, 82
Key Idea 6			
Standard 7			
Key Idea 1			73
Key Idea 2			
Standard 4			
Key Idea 1	2, 3, 4, 5, 6, 7, 8, 9, 24, 25, 26, 32, 35	36, 37, 45, 46, 47, 48, 51, 52, 53, 57, 58, 59, 60, 61, 62	78, 79, 80, 81, 82, 84, 85
Key Idea 2	1, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 27, 28, 29, 30, 31, 33	38, 39, 40, 41, 42, 43, 44, 63, 64, 65	66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 83
Key Idea 3	21, 23, 34	49, 50, 54, 55, 56	
Reference Tables			
ESRT 2011 Edition (Revised)	11, 14, 15, 17, 19, 20, 21, 22, 23, 25, 26, 29, 30, 32, 33, 34	36, 38, 39, 44, 49, 56, 57, 59, 60, 62	67, 74, 75, 80, 84, 85

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

Regents Examination in Physical Setting/Earth Science – January 2013

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 71 would receive a final examination score of 90.

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	97	97	96	96	95	95	94	93	92	91	90	89	88	86	84	82
78	97	96	96	95	95	94	94	93	92	91	90	89	88	87	85	83	82
77	97	96	96	95	95	94	94	93	92	91	90	89	88	87	85	83	82
76	96	95	95	95	94	94	93	92	91	91	89	88	87	86	84	83	81
75	95	95	94	94	93	93	92	91	91	90	89	88	86	85	83	82	80
74	95	95	94	94	93	93	92	91	91	90	89	88	86	85	83	82	80
73	94	94	93	93	92	92	91	90	90	89	88	87	86	84	83	81	79
72	93	93	92	92	92	91	90	90	89	88	87	86	85	83	82	80	78
71	92	92	92	91	91	90	90	89	88	87	86	85	84	82	81	79	77
70	92	92	92	91	91	90	90	89	88	87	86	85	84	82	81	79	77
69	92	91	91	90	90	89	89	88	87	86	85	84	83	82	80	78	77
68	91	90	90	89	89	88	88	87	86	85	84	83	82	81	79	77	76
67	90	90	89	89	88	88	87	86	85	85	84	82	81	80	78	77	75
66	89	89	88	88	87	87	86	85	85	84	83	82	80	79	77	76	74
65	89	89	88	88	87	87	86	85	85	84	83	82	80	79	77	76	74
64	88	88	87	87	86	86	85	85	84	83	82	81	80	78	77	75	73
63	87	87	87	86	86	85	84	84	83	82	81	80	79	77	76	74	72
62	86	86	86	85	85	84	84	83	82	81	80	79	78	77	75	73	71
61	86	85	85	84	84	83	83	82	81	80	79	78	77	76	74	72	71
60	85	84	84	84	83	82	82	81	80	79	78	77	76	75	73	72	70
59	84	84	83	83	82	82	81	80	80	79	78	77	75	74	72	71	69
58	83	83	82	82	81	81	80	79	79	78	77	76	74	73	71	70	68
57	82	82	81	81	81	80	79	79	78	77	76	75	74	72	71	69	67
56	81	81	81	80	80	79	78	78	77	76	75	74	73	71	70	68	66
55	80	80	80	79	79	78	78	77	76	75	74	73	72	71	69	67	65
54	80	79	79	78	78	77	77	76	75	74	73	72	71	70	68	66	65
53	79	78	78	78	77	77	76	75	74	74	72	71	70	69	67	66	64
52	78	78	77	77	76	76	75	74	74	73	72	71	69	68	66	65	63
51	77	77	76	76	75	75	74	73	73	72	71	70	69	67	66	64	62
50	76	76	75	75	75	74	73	73	72	71	70	69	68	66	65	63	61
49	75	75	75	74	74	73	73	72	71	70	69	68	67	65	64	62	60
48	75	74	74	73	73	72	72	71	70	69	68	67	66	65	63	61	60
47	74	73	73	72	72	71	71	70	69	68	67	66	65	64	62	60	59
46	73	73	72	72	71	71	70	69	68	68	67	65	64	63	61	60	58
45	71	71	70	70	69	69	68	68	67	66	65	64	63	61	60	58	56

Final Examination Scores
Regents Examination in Physical Setting/Earth Science – January 2013 – continued

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