

# Large-Type Edition

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

## PHYSICAL SETTING EARTH SCIENCE

Thursday, June 14, 2018 — 9:15 a.m. to 12:15 p.m., only

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Use your knowledge of Earth science to answer all questions in this examination. Before you begin this examination, you must be provided with the *2011 Edition Reference Tables for Physical Setting/Earth Science*. You will need these reference tables to answer some of the questions.

You are to answer all questions in all parts of this examination. You may use scrap paper to work out the answers to the questions, but be sure to record your answers on your answer sheet and in your answer booklet. A separate answer sheet for Part A and Part B–1 has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet. Record your answers to the Part A and Part B–1 multiple-choice questions on this separate answer sheet. Record your answers for the questions in Part B–2 and Part C in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.



All answers in your answer booklet should be written in pen, except for graphs and drawings, which should be done in pencil.

When you have completed the examination, you must sign the declaration printed on your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet and answer booklet cannot be accepted if you fail to sign this declaration.

Notice ...

A four-function or scientific calculator and a copy of the *2011 Edition Reference Tables for Physical Setting/Earth Science* must be available for you to use while taking this examination.

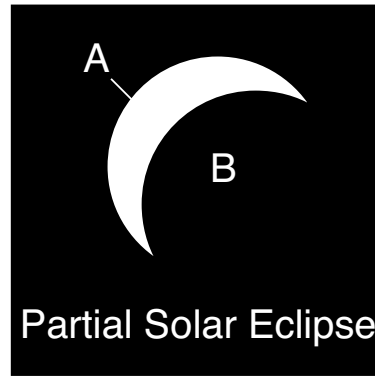
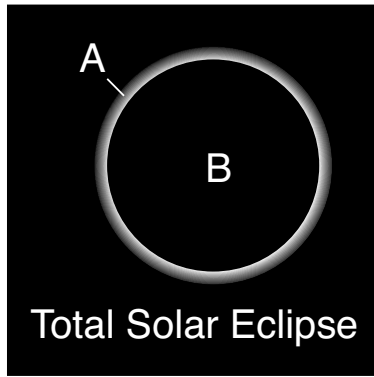
**DO NOT START THIS EXAMINATION UNTIL THE SIGNAL IS GIVEN.**

## Part A

Answer all questions in this part.

*Directions (1–35):* For *each* statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Earth Science*. Record your answers on your separate answer sheet.

- 1 The photographs below show two types of solar eclipses. Letters *A* and *B* represent two celestial objects.



Which two celestial objects are represented by letters *A* and *B*?

- (1) *A*-Moon; *B*-Sun      (3) *A*-Sun; *B*-Moon  
(2) *A*-Moon; *B*-Earth    (4) *A*-Sun; *B*-Earth

- 2 Compared to the terrestrial planets, the Jovian planets
- (1) are less massive
  - (2) are more dense
  - (3) have greater orbital velocities
  - (4) have shorter periods of rotation
- 3 Which event occurred more than 10 billion years ago?
- (1) Big Bang
  - (2) origin of life on Earth
  - (3) Pangaea begins to break up
  - (4) origin of Earth and its Moon

4 In 1851, French physicist Léon Foucault used a swinging pendulum to demonstrate that Earth

- (1) is rotating
- (2) is revolving
- (3) has a curved surface
- (4) has a gravitational pull

5 Approximately how many degrees does Earth travel in its orbit in one month?

- (1) 1°
- (2) 15°
- (3) 30°
- (4) 360°

6 What is the relative humidity when the dry-bulb temperature is 16°C and the wet-bulb temperature is 10°C?

- (1) 6%
- (2) 14%
- (3) 33%
- (4) 45%

7 Boarding up windows would be one emergency action most likely taken to prepare for which natural disaster?

- (1) earthquake
- (2) hurricane
- (3) flood
- (4) tsunami

8 Which diagram best represents the general position and direction of flow of the polar front jet stream in the Northern Hemisphere during the winter months?



(1)



(3)

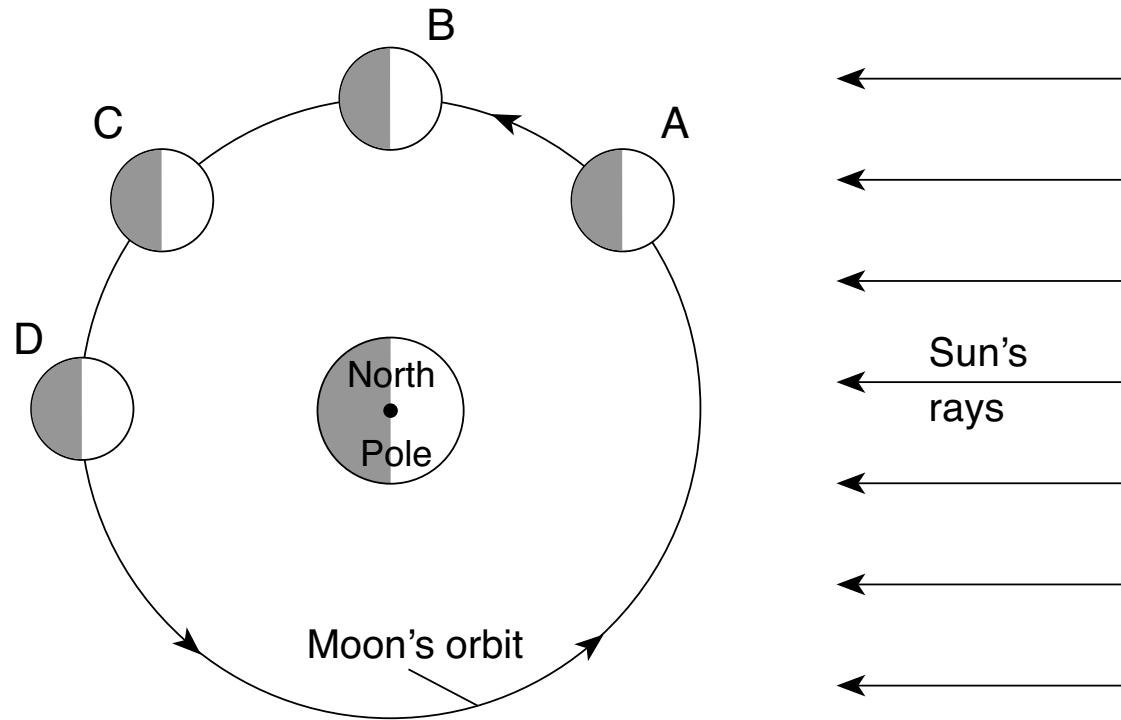


(2)



(4)

9 The diagram below represents four positions of the Moon, labeled A through D, as it orbits Earth.

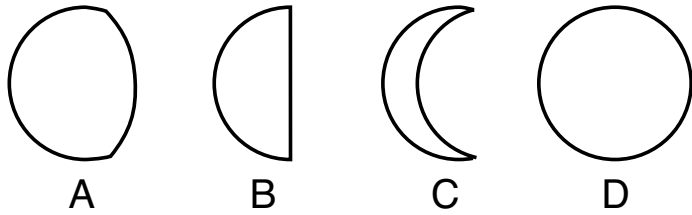


(Not drawn to scale)

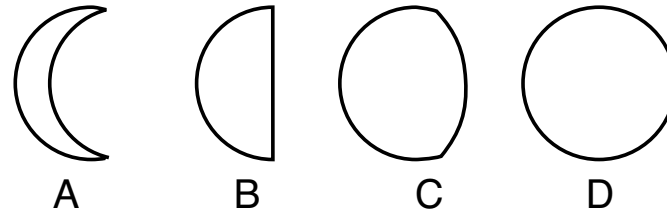
**Question 9 is continued on the next page.**

**Question 9 continued**

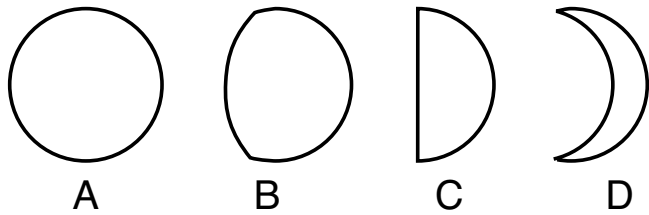
Which diagram best represents the sequence of Moon phases, as seen by an observer in New York State, when the Moon travels from position *A* to position *D* in its orbit around Earth?



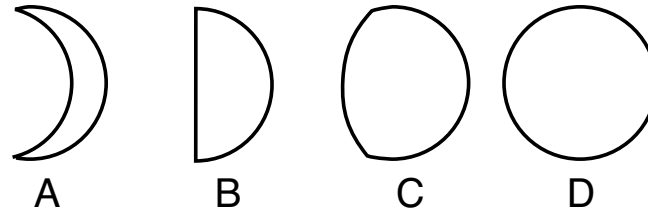
(1)



(3)



(2)



(4)

- 10 The diagrams below represent spectral lines of hydrogen gas observed in a laboratory and the spectral lines of hydrogen gas observed in the light from a distant star.

### Spectral Lines of Hydrogen in a Laboratory



Shorter Wavelength

Longer Wavelength

### Spectral Lines of Hydrogen from a Distant Star



Shorter Wavelength

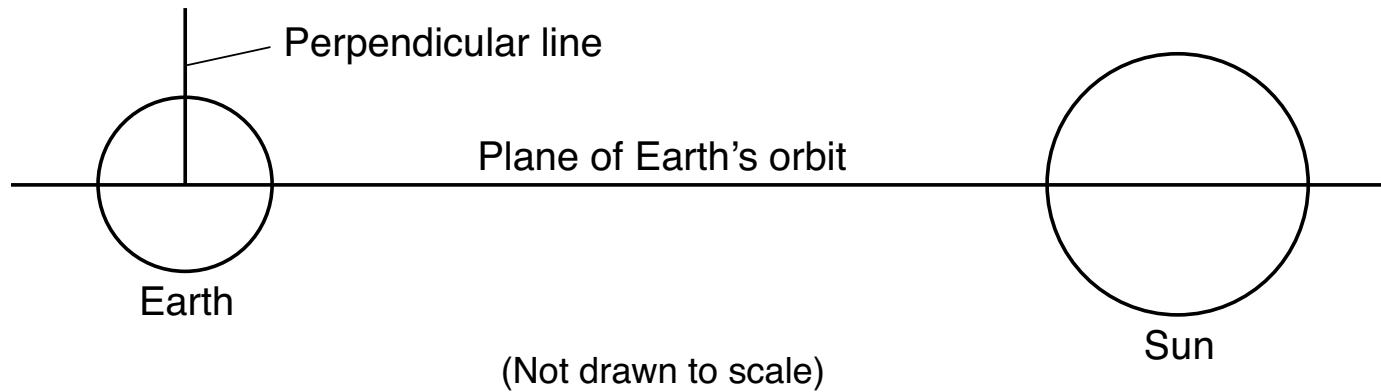
Longer Wavelength

Compared to the spectral lines observed in the laboratory, the spectral lines observed in the light from the distant star have shifted toward the

- (1) red end of the spectrum, indicating the star's movement toward Earth
- (2) red end of the spectrum, indicating the star's movement away from Earth
- (3) blue end of the spectrum, indicating the star's movement toward Earth
- (4) blue end of the spectrum, indicating the star's movement away from Earth



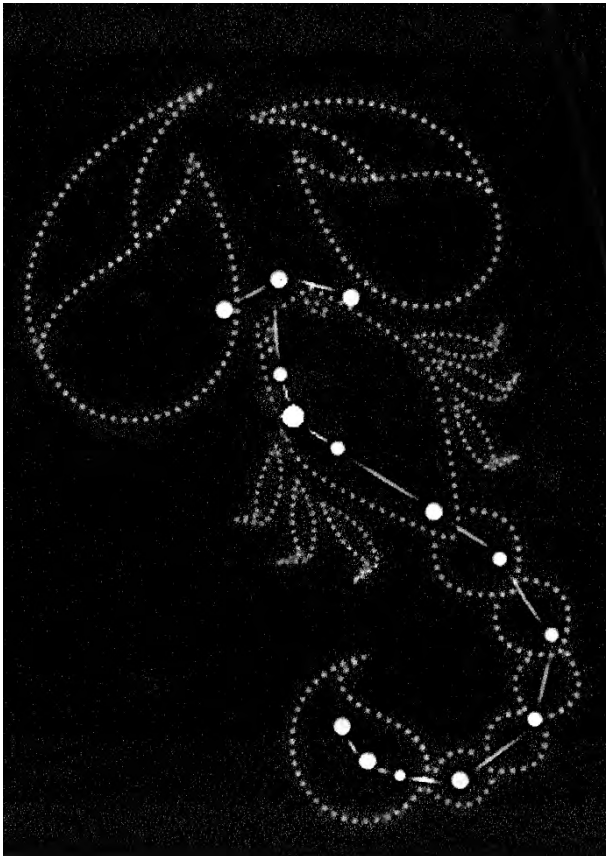
- 11 The diagram below represents a cross-sectional view of the plane of Earth's orbit around the Sun. A line drawn perpendicular to the plane of Earth's orbit is shown on the diagram.



How many degrees is Earth's rotational axis tilted with respect to the perpendicular line shown in the diagram?

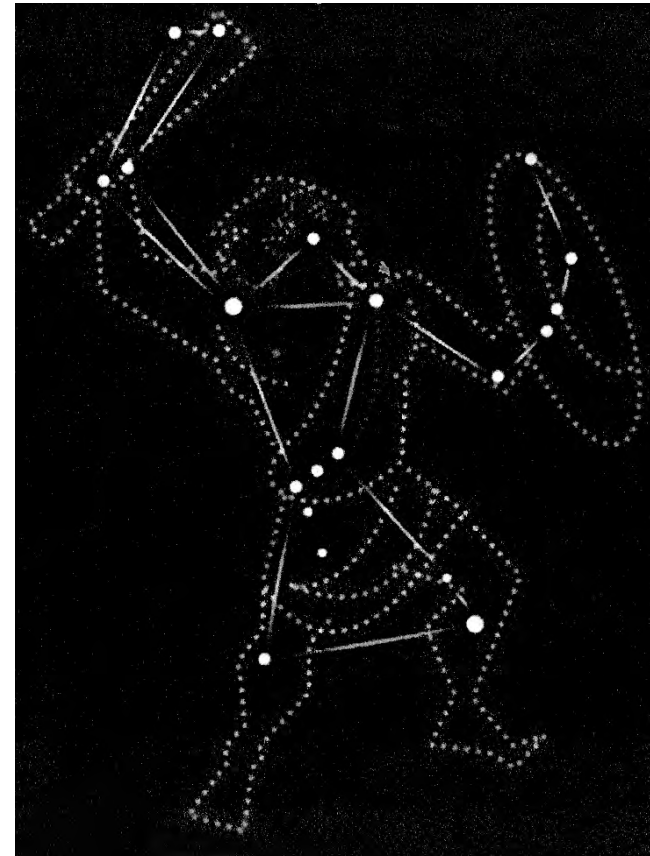
- (1)  $15^\circ$
- (2)  $23.5^\circ$
- (3)  $90^\circ$
- (4)  $180^\circ$

12 The larger white dots in the diagrams below represent stars in the constellations Scorpius and Orion. Information indicating when these constellations are visible from New York State is provided below the diagrams.



**Scorpius**

Visible in the New York State nighttime sky during July;  
not visible at all in January



**Orion**

Visible in the New York State nighttime sky during January;  
not visible at all in July

**Question 12 is continued on the next page.**

## Question 12 continued

Which statement best explains why these two constellations are visible in the night sky in the months identified?

- (1) Earth spins on its axis at a constant rate during a 24-hour period.
- (2) Earth spins on its axis at a variable rate during the year.
- (3) The nighttime side of Earth is facing different parts of our galaxy as Earth orbits the Sun.
- (4) The nighttime side of Earth is facing different parts of our galaxy as the stars orbit Earth.

13 Which table correctly shows the interior temperature, melting point, and state (phase) of matter of the materials located 4000 kilometers below Earth's surface?

<b>Interior Temperature (°C)</b>	<b>Melting Point (°C)</b>	<b>State of Matter</b>
5700	5400	solid

( 1 )

<b>Interior Temperature (°C)</b>	<b>Melting Point (°C)</b>	<b>State of Matter</b>
5400	5700	solid

( 3 )

<b>Interior Temperature (°C)</b>	<b>Melting Point (°C)</b>	<b>State of Matter</b>
5700	5400	liquid

( 2 )

<b>Interior Temperature (°C)</b>	<b>Melting Point (°C)</b>	<b>State of Matter</b>
5400	5700	liquid

( 4 )

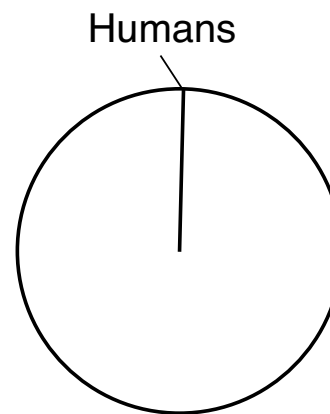
14 Which gas is a greenhouse gas that has increased in Earth's atmosphere partly as a result of deforestation over the last 100 years?

- (1) ozone
- (2) oxygen
- (3) nitrogen
- (4) carbon dioxide

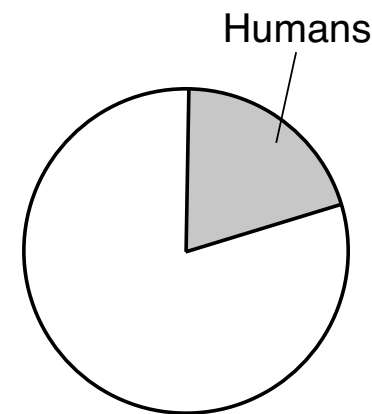
15 Which ocean current brings warm water to the southeastern tip of Africa?

- (1) Brazil Current
- (2) Agulhas Current
- (3) Guinea Current
- (4) Benguela Current

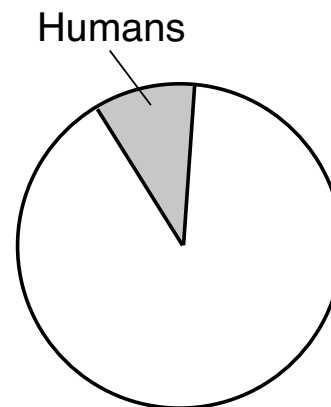
16 Which pie graph is shaded to best represent the approximate percentage of time that humans have existed during Earth's entire history?



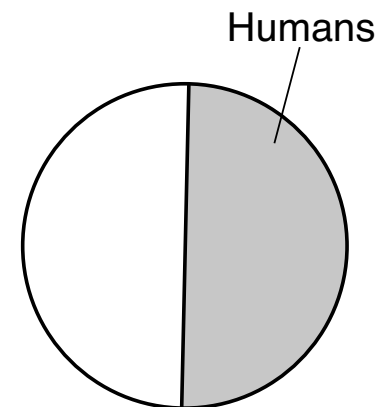
(1)



(3)



(2)

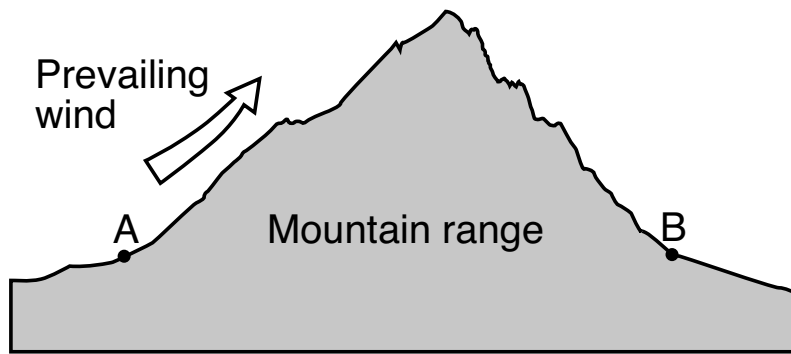


(4)

17 Volcanic ash can be used as a time marker to correlate rock layers because the ash

- (1) is deposited rapidly over a large area
- (2) represents a buried erosional surface
- (3) forms intrusive igneous rock
- (4) cuts across rock layers

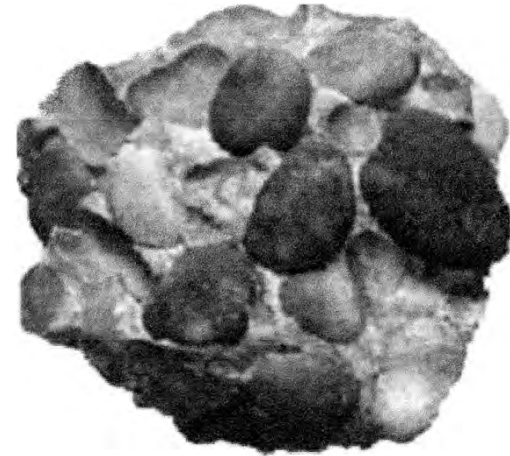
18 The cross section below represents a mountain range. Points *A* and *B* represent locations on Earth's surface.



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

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

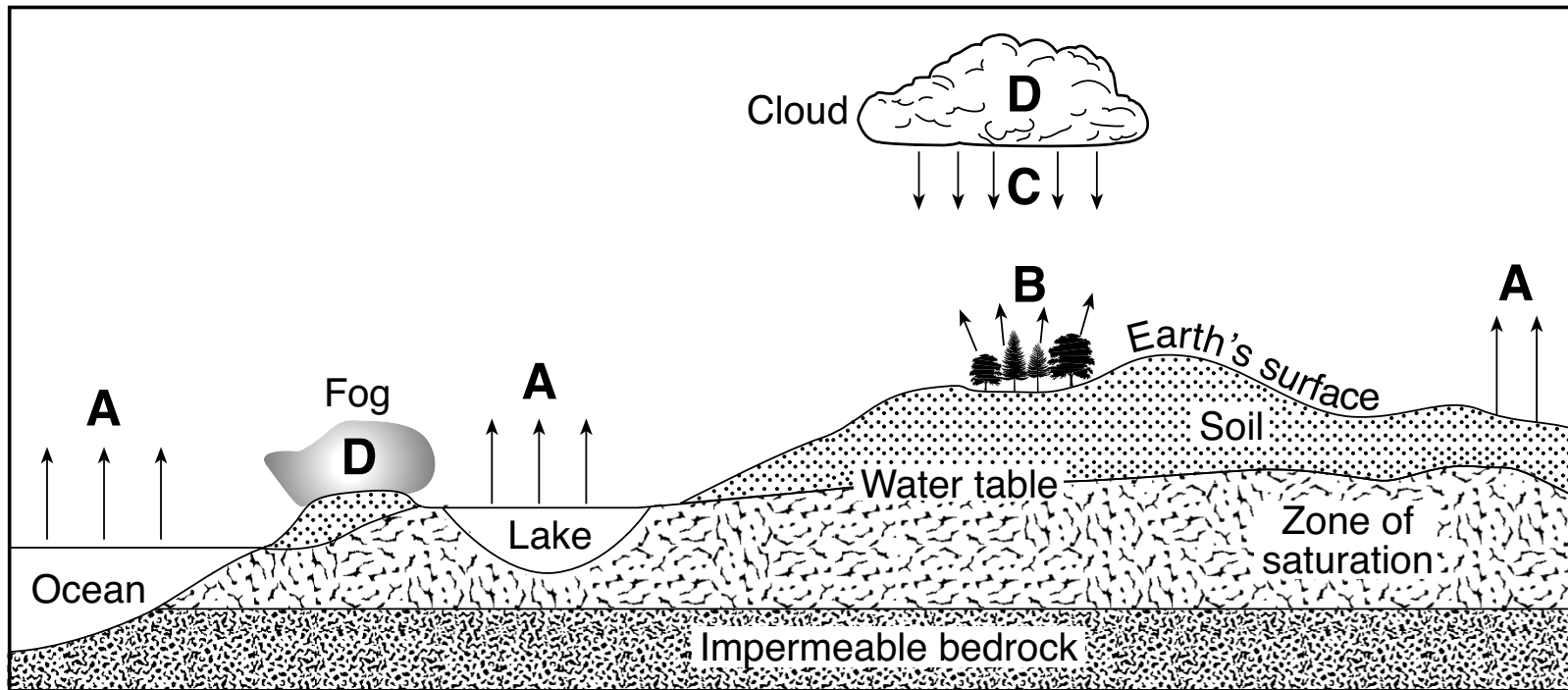
19 The photograph below shows conglomerate composed of pebbles cemented together with calcite.



Compared to the ages of the calcite cement and the conglomerate, the relative age of the pebbles is

- (1) younger than both the calcite cement and the conglomerate
- (2) younger than the calcite cement, but the same age as the conglomerate
- (3) older than both the calcite cement and the conglomerate
- (4) older than the calcite cement, but the same age as the conglomerate

20 The cross section below represents some parts of Earth's water cycle. Letters A, B, C, and D represent processes that occur during the cycle.



Question 20 is continued on the next page.

## Question 20 continued

Which table correctly matches each letter with the process it represents?

Letter	Process
A	Condensation
B	Transpiration
C	Precipitation
D	Evaporation

( 1 )

Letter	Process
A	Condensation
B	Evaporation
C	Precipitation
D	Transpiration

( 3 )

Letter	Process
A	Evaporation
B	Precipitation
C	Transpiration
D	Condensation

( 2 )

Letter	Process
A	Evaporation
B	Transpiration
C	Precipitation
D	Condensation

( 4 )

21 Which table best shows the relationship between latitude and general climate conditions on Earth?

Latitude	Climate Conditions
90°N	Arid
60°N	Arid
30°N	Humid
0°	Humid
30°S	Humid
60°S	Arid
90°S	Arid

( 1 )

Latitude	Climate Conditions
90°N	Arid
60°N	Humid
30°N	Arid
0°	Humid
30°S	Arid
60°S	Humid
90°S	Arid

( 2 )

Latitude	Climate Conditions
90°N	Humid
60°N	Arid
30°N	Humid
0°	Humid
30°S	Humid
60°S	Arid
90°S	Humid

( 3 )

Latitude	Climate Conditions
90°N	Humid
60°N	Arid
30°N	Humid
0°	Arid
30°S	Humid
60°S	Arid
90°S	Humid

( 4 )



22 The photograph below shows different-sized rounded sediment.



Which table shows the most likely process and agent of erosion responsible for this rounded sediment?

Process	Agent of Erosion
sandblasting	running water

( 1 )

Process	Agent of Erosion
land slide	mass movement

( 3 )

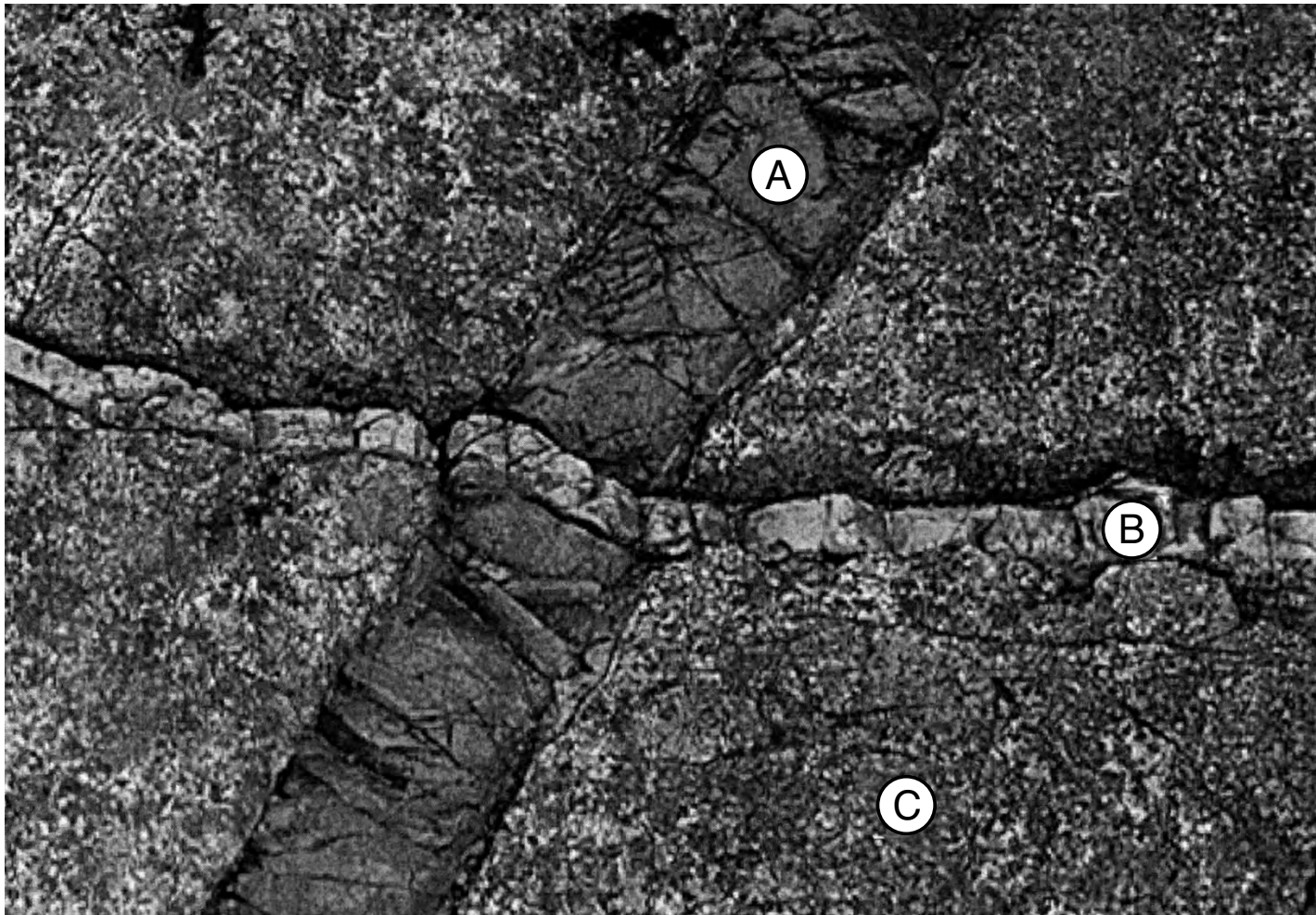
Process	Agent of Erosion
abrasion	wave action

( 2 )

Process	Agent of Erosion
deposition	wind

( 4 )

23 The photograph below shows an outcrop with two basaltic intrusions, labeled *A* and *B*, in a rock unit, labeled *C*.



What is the relative age of these three rock units from oldest to youngest?

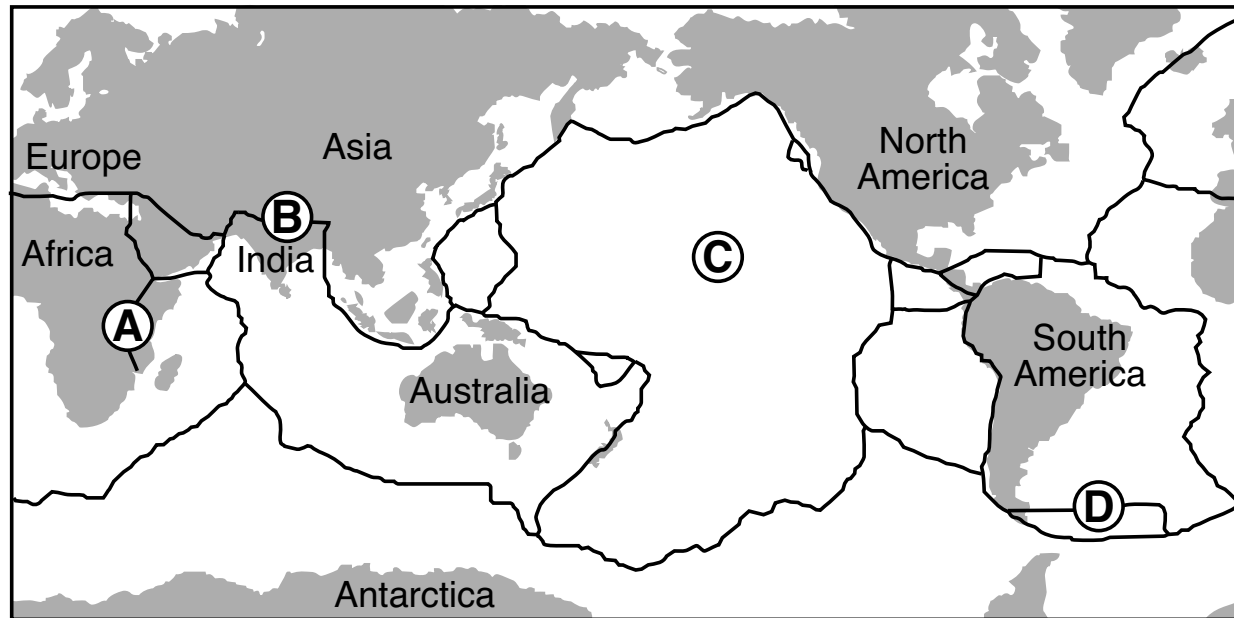
(1)  $B \rightarrow A \rightarrow C$

(2)  $B \rightarrow C \rightarrow A$

(3)  $C \rightarrow A \rightarrow B$

(4)  $C \rightarrow B \rightarrow A$

24 The world map below shows Earth's major tectonic plate boundaries. Letters *A* through *D* represent four surface locations.



Which location is on a major rift valley?

(1) *A*

(2) *B*

(3) *C*

(4) *D*

25 The first *P*-wave of an earthquake took 11 minutes to travel to a seismic station from the epicenter of the earthquake. What is the seismic station's distance to the epicenter of the earthquake and how long did it take for the first *S*-wave to travel that distance?

- (1) Distance to epicenter: 3350 km  
S-wave travel time: 4 min 50 sec
- (2) Distance to epicenter: 3350 km  
S-wave travel time: 6 min 10 sec
- (3) Distance to epicenter: 7600 km  
S-wave travel time: 9 min
- (4) Distance to epicenter: 7600 km  
S-wave travel time: 20 min

26 The Catskills are commonly called mountains, but are actually part of the Allegheny Plateau. The Catskills are classified as a plateau because of their

- (1) low elevation
- (2) bedrock structure
- (3) bedrock age
- (4) high degree of metamorphism

27 The minimum stream velocity necessary to transport a sediment particle that is 0.1 centimeter in diameter is closest to

- (1) 0.1 cm/s
- (2) 0.002 cm/s
- (3) 5.5 cm/s
- (4) 10.0 cm/s

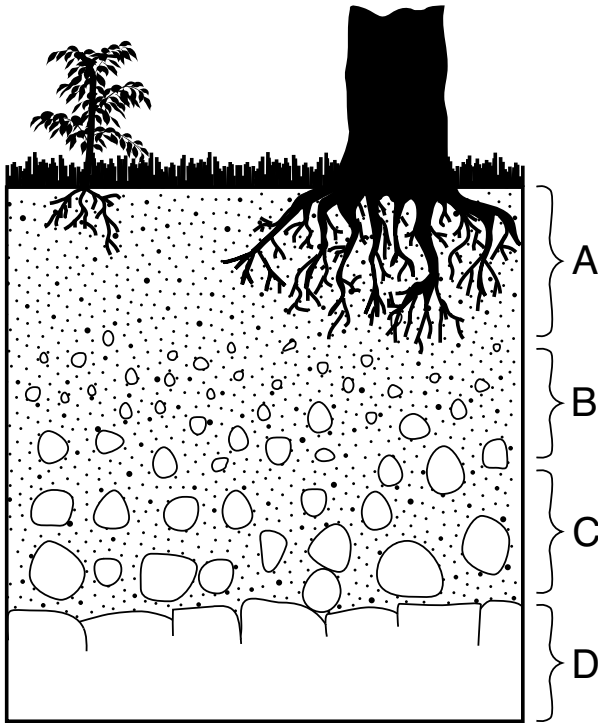
28 Which rock is classified as an evaporite?

- (1) clastic shale
- (2) foliated phyllite
- (3) nonfoliated marble
- (4) crystalline rock salt

29 Which pair of elements makes up most of Earth's crust by volume?

- (1) nitrogen and potassium
- (2) oxygen and silicon
- (3) hydrogen and oxygen
- (4) potassium and oxygen

30 The cross section below represents zones of soil labeled A, B, and C. Letter D represents underlying bedrock.



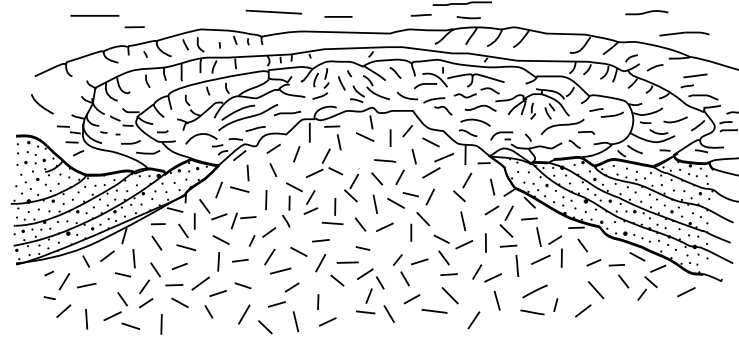
Which letter identifies the zone having the most organic and weathered material?

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

31 Which type of surface bedrock is most commonly found in the Utica, New York area?

- (1) sedimentary, with limestone, shale, sandstone, and dolostone
- (2) sedimentary, with limestone, shale, sandstone, and conglomerate
- (3) metamorphic, with quartzite, dolostone, marble, and schist
- (4) metamorphic, with gneiss, quartzite, marble, and slate

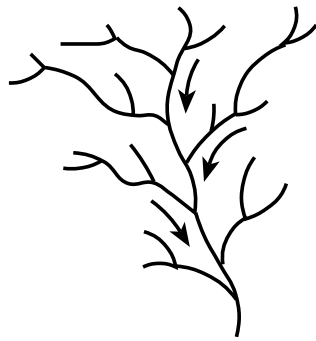
32 The diagram below represents a geologic landscape.



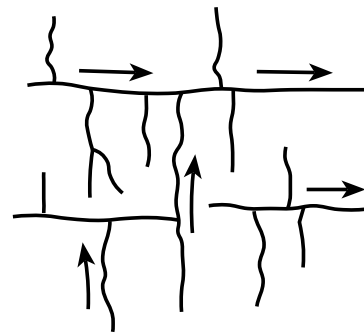
Which type of stream drainage pattern formed on this landscape?



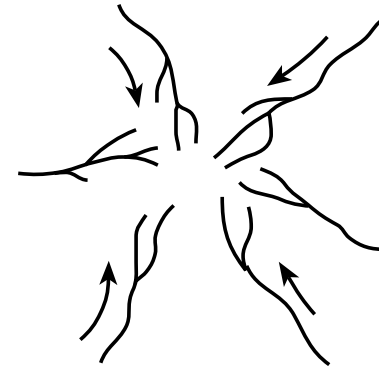
(1)



(2)

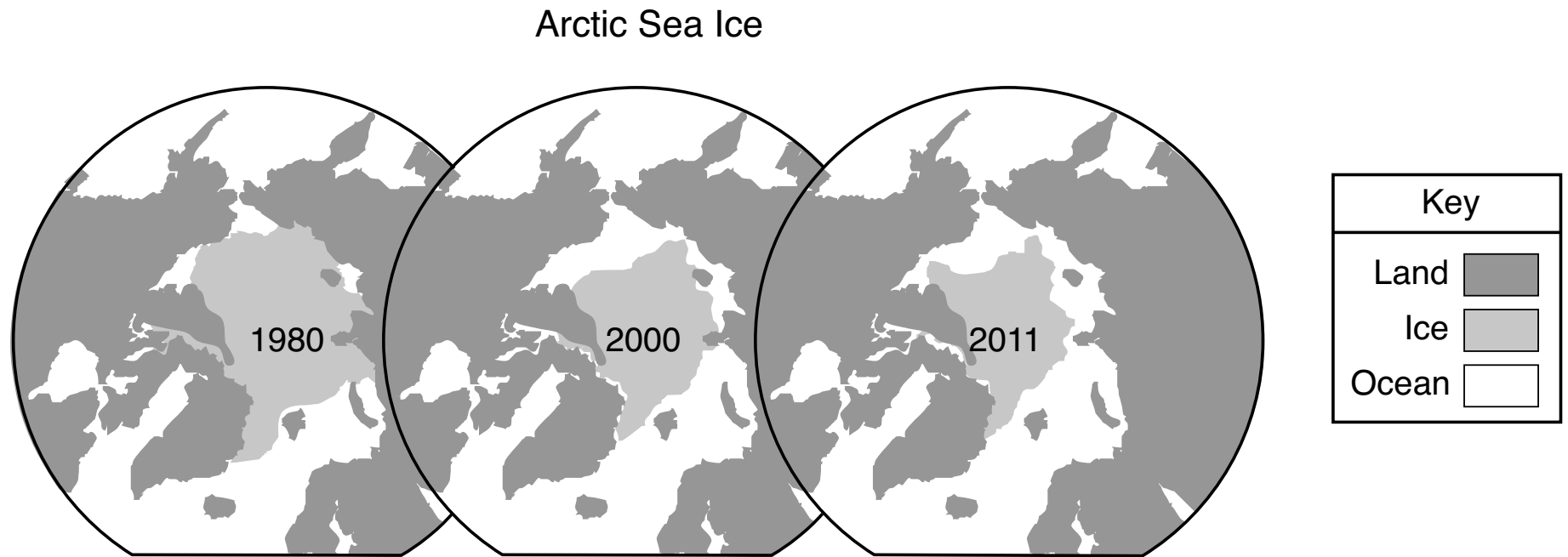


(3)



(4)

33 The north polar view maps below show the average area covered by Arctic Sea ice in September of 1980, 2000, and 2011.



The maps best support the inference that Earth's climate is

- (1) cooling, because the average area covered by Arctic Sea ice is decreasing
- (2) cooling, because the average area covered by Arctic Sea ice is increasing
- (3) warming, because the average area covered by Arctic Sea ice is decreasing
- (4) warming, because the average area covered by Arctic Sea ice is increasing

34 The photographs below shows two depositional features labeled *A* and *B*.



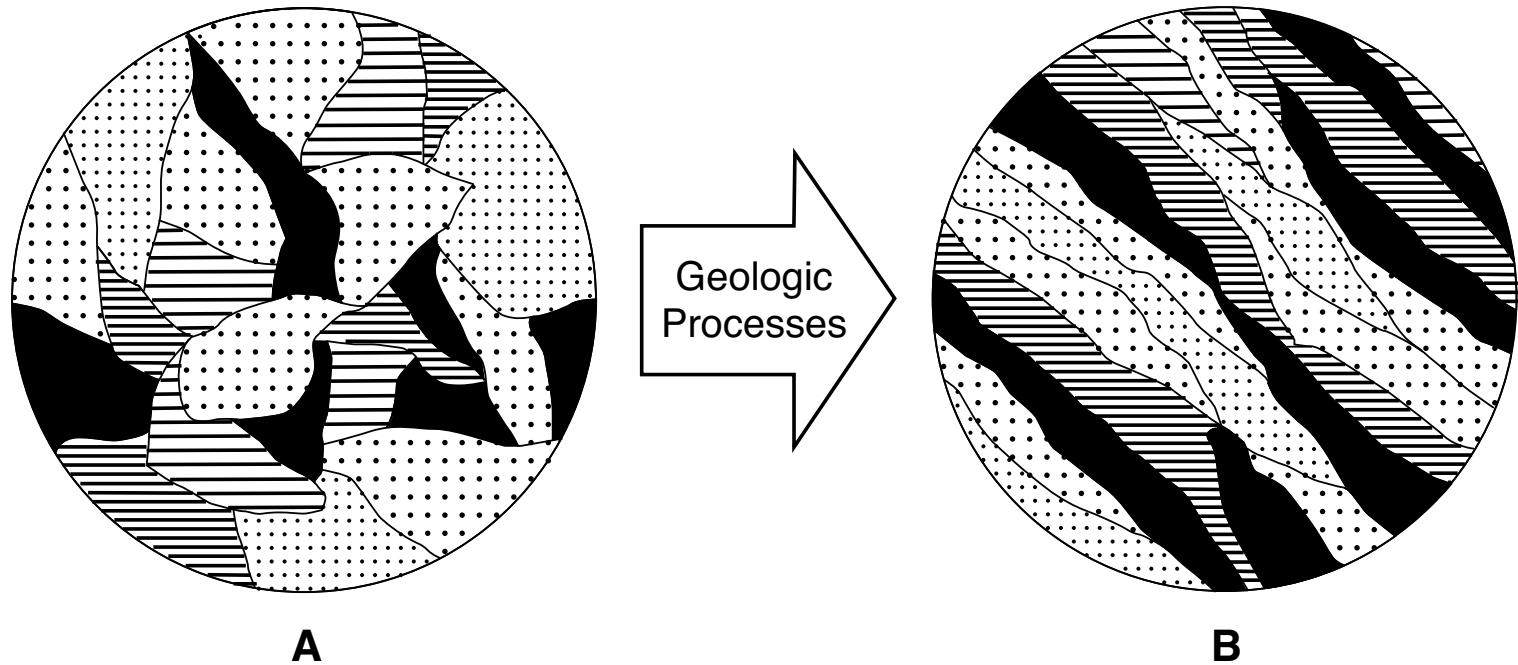
Which terms correctly identify depositional features *A* and *B*?

- (1) *A*-delta; *B*-barrier island
- (2) *A*-sand bar; *B*-island arc

- (3) *A*-barrier island; *B*-delta
- (4) *A*-island arc; *B*-sand bar



35 Diagrams *A* and *B* represent magnified views of the arrangement of mineral crystals in a rock before and after being subjected to geologic processes.



Which geologic processes are most likely responsible for the banding and alignment of mineral crystals represented in diagram *B*?

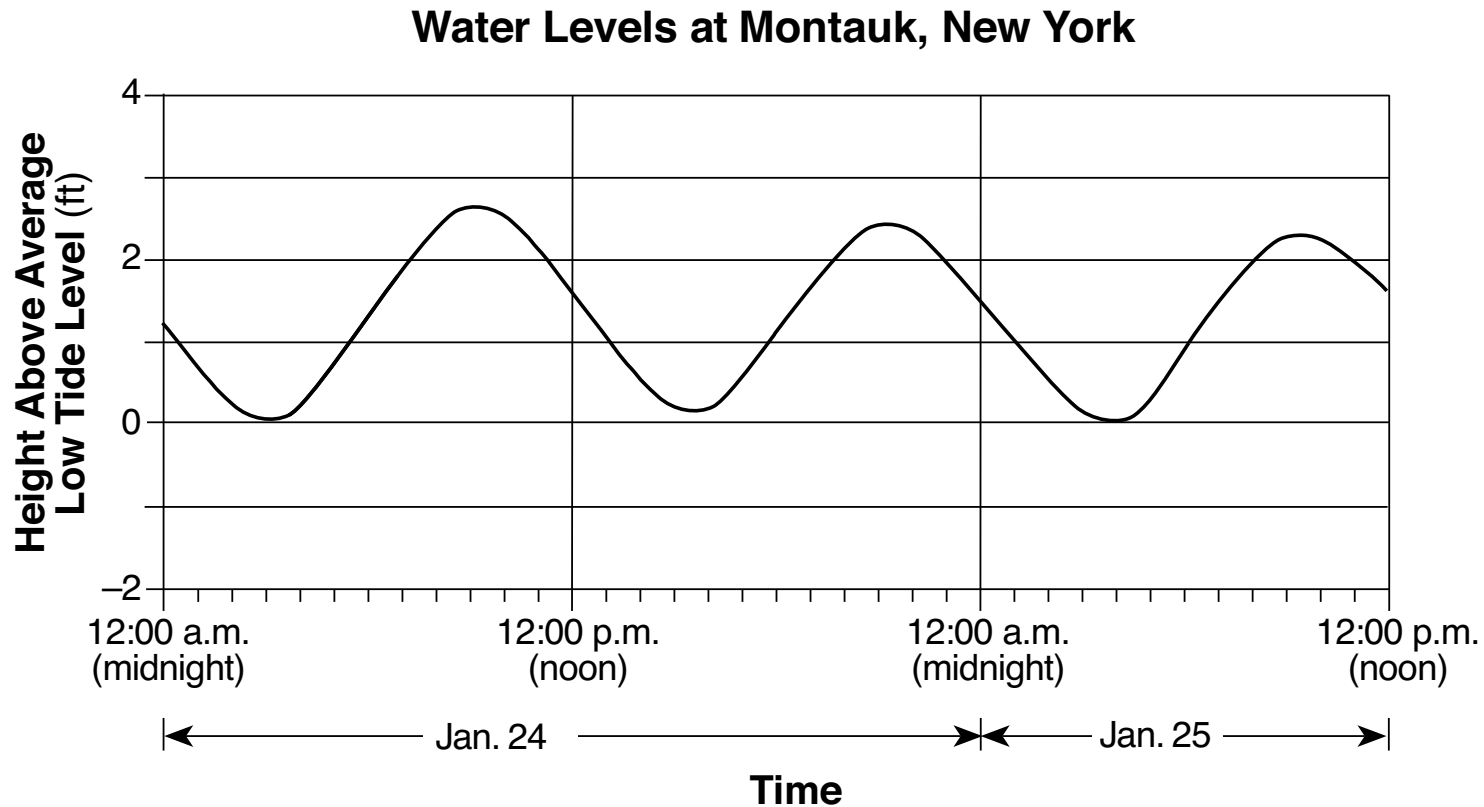
- |                                     |                                |
|-------------------------------------|--------------------------------|
| (1) melting and solidification      | (3) compaction and cementation |
| (2) heating and increasing pressure | (4) weathering and erosion     |
-

## 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 39 on the graph below and on your knowledge of Earth science. The graph shows the observed water levels, in feet (ft), for a tide gauge located at Montauk, New York, on the easternmost end of Long Island, from January 24, 2008 to noon on January 25, 2008.



36 What was the height of the water above average low tide level at noon on January 24?

(1) 1.2 ft

(3) 2.2 ft

(2) 1.6 ft

(4) 2.6 ft

37 These changing water levels at Montauk can best be described as

(1) cyclic and predictable

(3) noncyclic and predictable

(2) cyclic and not predictable

(4) noncyclic and not predictable

38 What causes the water-level variation pattern shown by the graph?

(1) changes in wind velocity produced by coastal storms

(2) changes in magnetic orientation of the North American Plate

(3) Earth's revolution and the distance from the equator

(4) Earth's rotation and the gravitational pull of the Moon

39 What is the approximate latitude and longitude of the tide gauge?

(1)  $40^{\circ}30'$  N  $72^{\circ}00'$  W

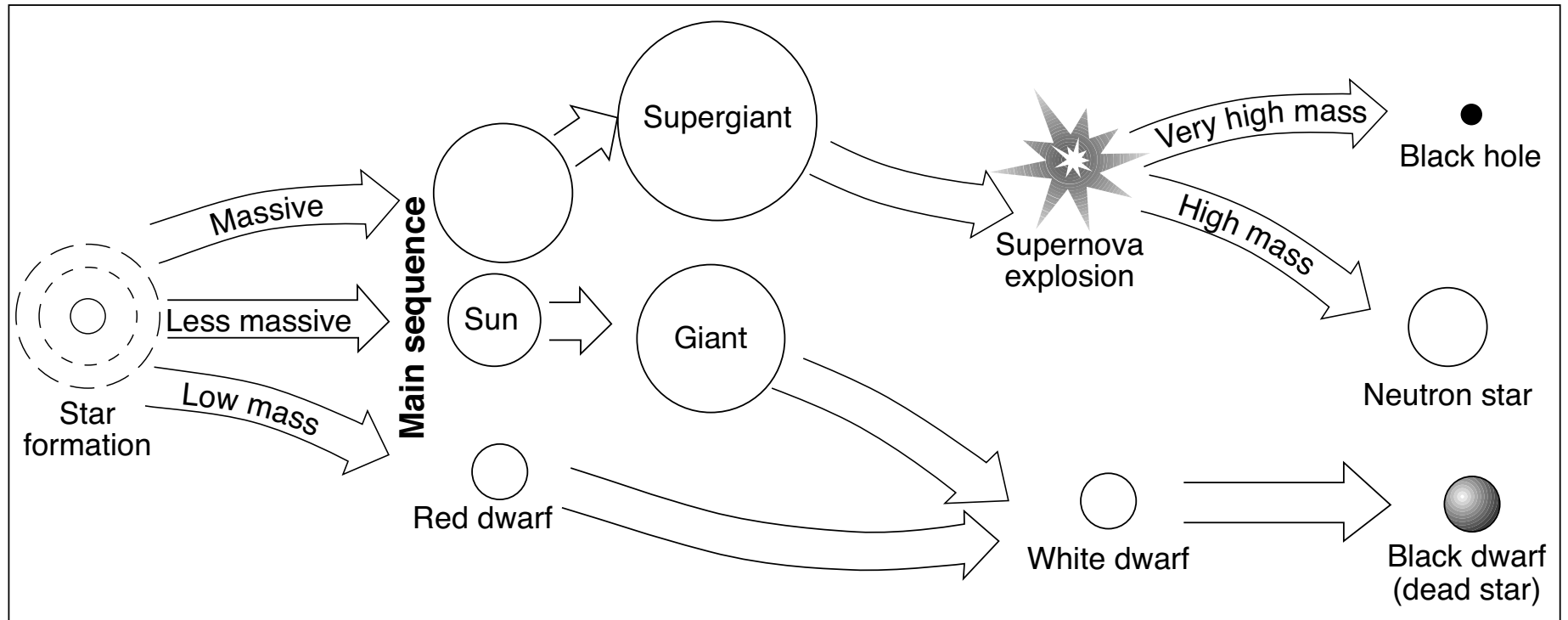
(3)  $41^{\circ}00'$  N  $72^{\circ}00'$  W

(2)  $40^{\circ}30'$  N  $74^{\circ}00'$  W

(4)  $41^{\circ}00'$  N  $74^{\circ}00'$  W

---

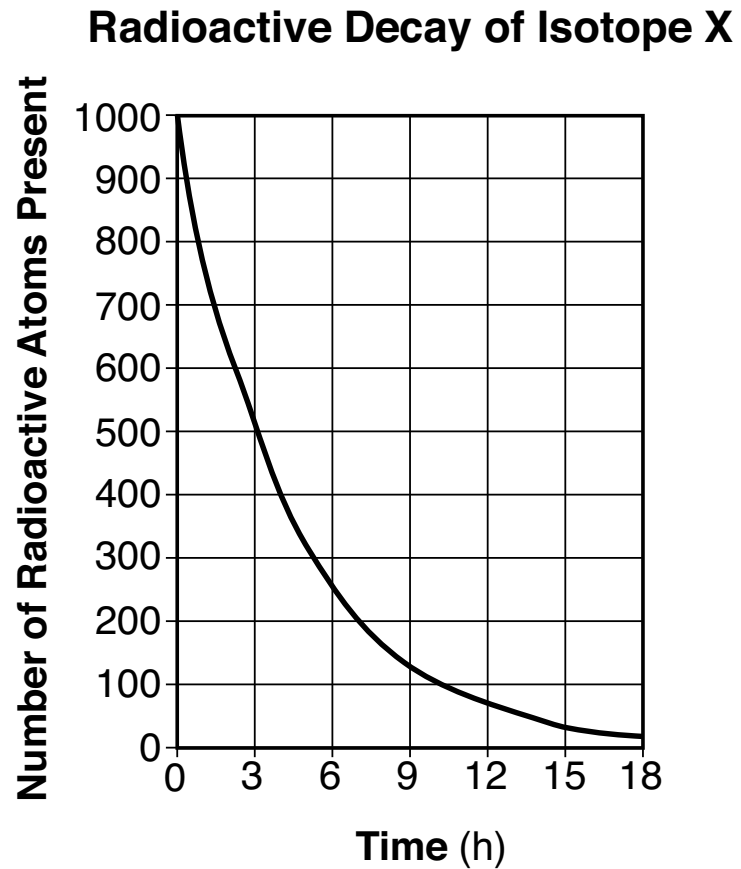
Base your answers to questions 40 through 42 on the diagram below and on your knowledge of Earth science. The diagram represents some of the inferred stages in the life cycle of stars according to their original mass.



(Not drawn to scale)

- 40 The final stage in the life cycle of the most massive stars is a
- (1) black hole
  - (2) black dwarf
  - (3) supergiant
  - (4) white dwarf
- 41 Which star may once have been similar to our Sun in mass and luminosity?
- (1) *Deneb*
  - (2) *Spica*
  - (3) *Procyon B*
  - (4) *Proxima Centauri*
- 42 Energy is produced in the cores of main sequence stars when
- (1) lighter elements undergo fusion into heavier elements
  - (2) heavier elements undergo fusion into lighter elements
  - (3) cosmic background radiation is absorbed
  - (4) cosmic background radiation is released
-

Base your answers to questions 43 and 44 on the graph below and on your knowledge of Earth science. The graph shows the number of radioactive Isotope X atoms present as a sample of the isotope undergoes radioactive decay.



43 Based on the graph, the half-life of this radioactive isotope is

(1) 6 h

(3) 3 h

(2) 9 h

(4) 12 h

44 Based on the graph, what is the approximate number of radioactive atoms of Isotope X that are present when 8 hours of decay has occurred?

(1) 90

(3) 155

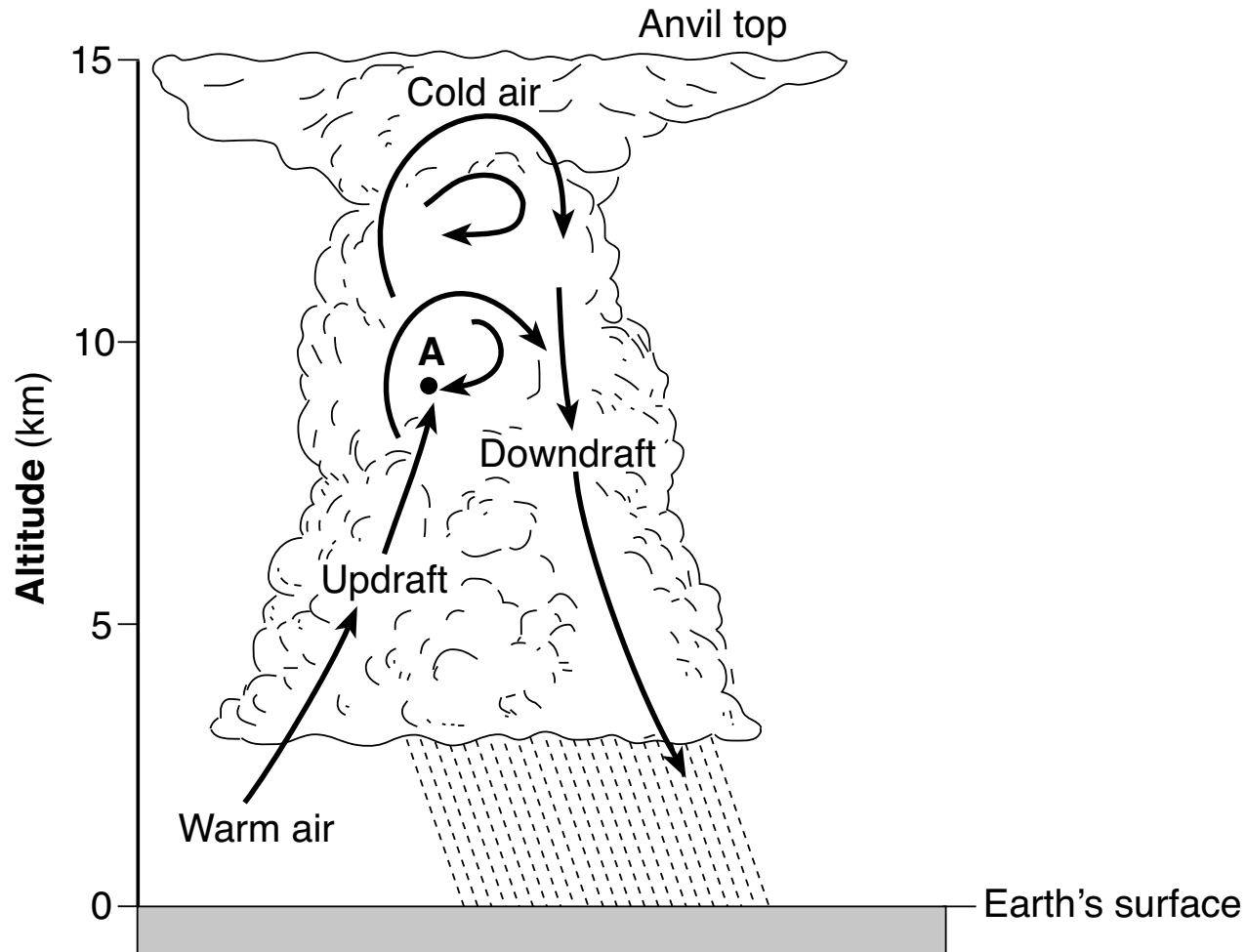
(2) 115

(4) 200

---

**GO RIGHT ON TO THE NEXT PAGE →**

Base your answers to questions 45 through 47 on the diagram below and on your knowledge of Earth science. The arrows in the diagram show air movement in a thunderstorm cloud. Point A represents a location in the atmosphere.





45 In which temperature zone of the atmosphere is point A located?

(1) thermosphere

(3) stratosphere

(2) mesosphere

(4) troposphere

46 The updrafts and downdrafts represented within this cloud are primarily caused by differences in

(1) altitude above sea level

(3) relative humidity

(2) air density

(4) specific heat

47 Which weather symbol would be placed on a station model to represent this weather event?



(1)



(2)



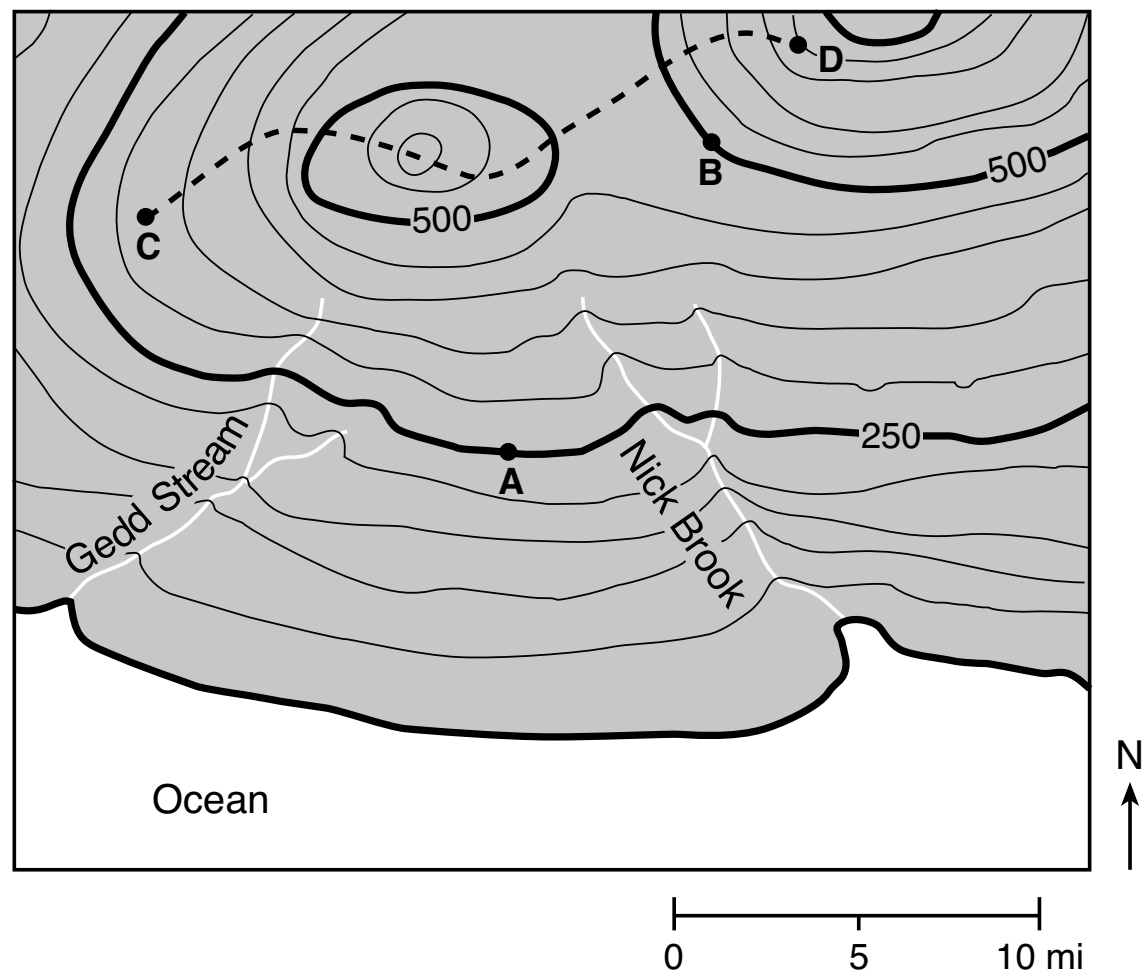
(3)



(4)

---

Base your answers to questions 48 through 50 on the topographic map below and on your knowledge of Earth science. On the map, points *A*, *B*, *C*, and *D* represent surface locations. The dashed line between points *C* and *D* represents a hiking trail. Elevations are in feet (ft).



48 What is the contour interval on this map?

(1) 25 ft

(2) 50 ft

(3) 150 ft

(4) 250 ft

49 The gradient between location *A* and location *B* is approximately

(1) 0.04 ft/mi

(2) 25 ft/mi

(3) 40 ft/mi

(4) 50 ft/mi

50 A person walks along the trail from location *C* to location *D*. The person will be walking

(1) downhill then uphill, only

(2) downhill, then uphill, then downhill again

(3) uphill then downhill, only

(4) uphill, then downhill, then uphill again

---

**GO RIGHT ON TO THE NEXT PAGE ➔**

## 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 passage below and on your knowledge of Earth science.

### **The Mica Family**

The familiar term “mica” is not the name of a specific mineral, but rather the name for a family of more than 30 minerals that share the same properties. All members of the mica family have high melting points and are similar in density, luster, hardness, streak, type of breakage, and crystal shape. As a result, telling the micas apart can be difficult. However, some common members of the family can be identified by color. For example, biotite is black to dark brown while muscovite can be light shades of several colors, or even colorless. When less common members of the mica family have any of these colors, or have similar colors, chemical tests are needed to tell them apart.

- 51 Identify the *two* chemical elements present in biotite mica that are *not* present in muscovite mica. [1]
- 52 Identify the luster, hardness, and dominant form of breakage for members of the mica family. [1]
- 53 State the name of the igneous rock in which crystals of biotite mica are larger than 10 millimeters in diameter. [1]
- 54 Large crystals of mica, sometimes weighing several hundred tons, have been found in igneous rock in Canada. Identify the environment of formation and the relative rate of cooling of the magma that formed the igneous rock containing these large crystals. [1]
- 

**GO RIGHT ON TO THE NEXT PAGE ➔**

Base your answers to questions 55 through 58 on the diagram in your answer booklet and on your knowledge of Earth science. The diagram represents the Sun's apparent daily path for the first day of three seasons at 43° North latitude. The solid lines represent daytime paths as seen by an observer at this latitude. The dashed lines represent the nighttime paths that can *not* be seen by the observer.

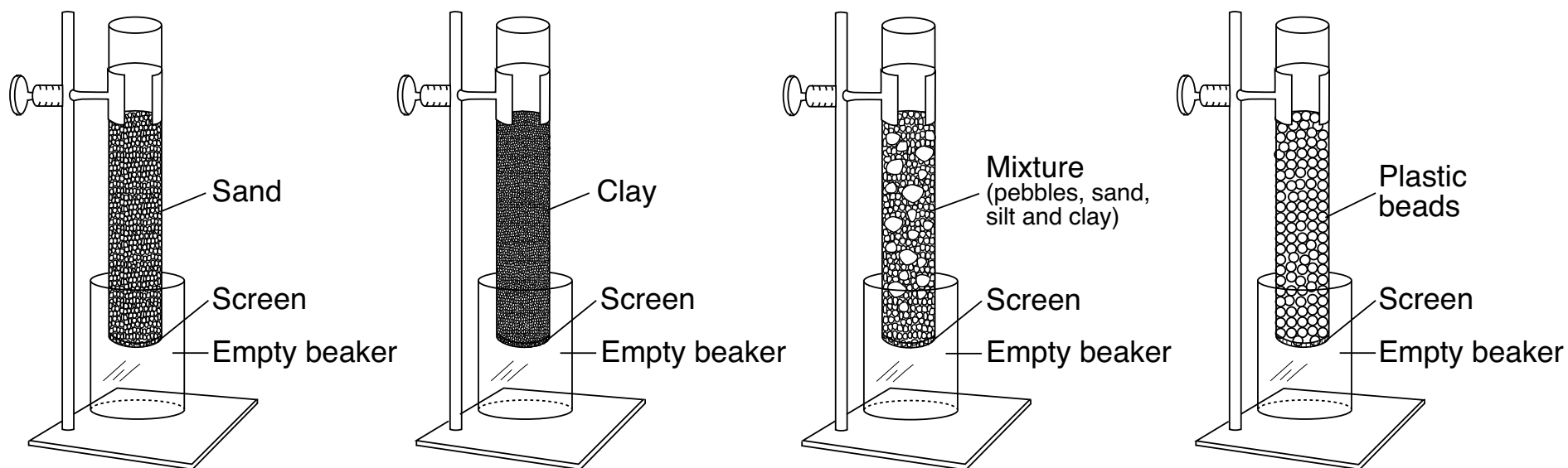
- 55 On the diagram *in your answer booklet*, draw an **X** to represent the solar noon position of the Sun as seen by the observer on April 21. [1]
- 56 Identify the rate of the Sun's apparent movement, in degrees per hour, along its path on December 21. [1]
- 57 Identify the compass direction toward which the observer's shadow would point at solar noon on March 21. [1]
- 58 List the three dates shown on the diagram from the least number of nighttime hours to the greatest number of nighttime hours. [1]
-

Base your answers to questions 59 through 62 on the information below, on the map in your answer booklet, and on your knowledge of Earth science. The map shows a portion of the tectonic plates map from the *2011 Edition Reference Tables for Physical Setting/Earth Science*. Letters *A* and *B* represent locations on the ocean floor.

The area between North America and South America is a tectonically active region of Earth. This region contains all of the types of tectonic plate boundaries, and it has frequent earthquake and volcanic activity. The tectonic plates on either side of the East Pacific Ridge move at an average rate of 7.5 cm/year.

- 59 On the map *in your answer booklet*, draw *one* arrow in each of the two boxes to show the relative motion of the Caribbean Plate and the North American Plate. [1]
- 60 On the set of axes *in your answer booklet*, draw a line to represent the relative age of the ocean floor bedrock from location *A* to location *B*. [1]
- 61 Identify the name of the hot spot shown on the map, and identify the name of the tectonic plate under which the center of this hot spot is located. [1]
- 62 Identify the type of mafic igneous bedrock that is most likely to make up the oceanic crust at location *A*, and state the average density of this oceanic crust. [1]
-

Base your answers to questions 63 through 65 on the diagram and data table below and on your knowledge of Earth science. The diagram represents laboratory materials used for an investigation of the effects of particle diameter on permeability and porosity (percentage of pore space). Four separate plastic tubes were filled to the same level with different particles. Four separate plastic tubes were filled to the same level with different particles.



(Not drawn to scale)

Particle Type	Particle Diameter (cm)	Time for Water to Infiltrate (s)	Porosity (%)
Sand	0.1	7	42.0
Clay	0.0003	322	40.0
Mixture	from 0.0003 to 0.8	15	34.0
Plastic beads	0.4	4	44.0



- 63 Explain why the particle sizes fit together more closely in the mixture, resulting in the lowest porosity of all these particle types. [1]
- 64 The height of the column of sand is 28 centimeters. Calculate the rate of infiltration, in centimeters per second, for the water that flowed through the column of sand. [1]
- 65 Based on the particle diameter of the plastic beads, identify the type of sediment represented by these beads. [1]
- 

**GO RIGHT ON TO THE NEXT PAGE ➡**

**GO RIGHT ON TO THE NEXT PAGE →**

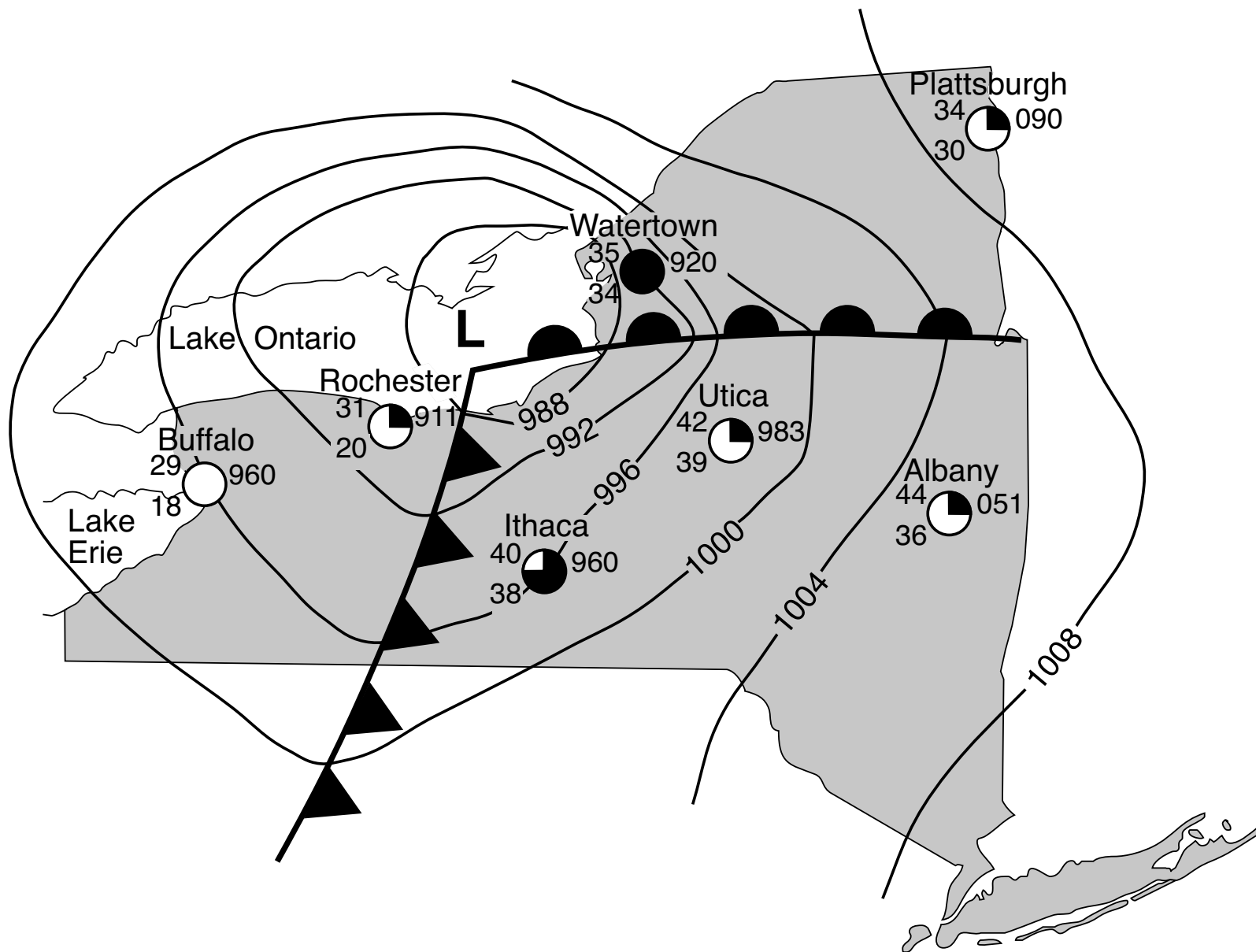
## Part C

**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*.

**GO RIGHT ON TO THE NEXT PAGE ➔**

Base your answers to questions 66 through 68 on the weather map below and on your knowledge of Earth science. The map shows the location of a wintertime low-pressure system over Lake Ontario with two fronts extending into New York State. Isobar values are recorded in millibars. Partial weather station data are shown for several locations.



- 66 Describe the evidence shown on the map that indicates that the highest wind speeds occurred near Watertown, New York. [1]
- 67 Complete the table *in your answer booklet* by recording the weather data shown on the station model for Albany, New York. [1]
- 68 State the compass direction toward which the center of this low-pressure system moved over the next two days if the low followed a normal storm track. [1]
- 

**GO RIGHT ON TO THE NEXT PAGE ➔**

Base your answers to questions 69 through 72 on the information and data table below and on your knowledge of Earth science. The data table shows the average body volume, including the shell, of a brachiopod at certain times in geologic history. The geologic ages are shown in million years ago (mya). The average body volumes including the shell are shown in milliliters (mL).

### **Cope's Rule**

Cope's Rule states that the average size of animals preserved in the fossil record tends to increase as each group evolves from a previous group. This rule was first proposed in the 1800s by Edward Drinker Cope, a famous fossil hunter of that time. Recent research, involving well over 10,000 fossil groups spanning the time since the start of the Cambrian Period until today, has shown that Cope's Rule is accurate for most animal groups. Brachiopod data support Cope's Rule.

**Brachiopod Data Table**

<b>Geologic Age (mya)</b>	<b>Average Body Volume Including the Shell (mL)</b>
480	0.1
460	0.2
430	0.6
410	1.0
380	1.1

- 69 On the grid *in your answer booklet*, plot the average brachiopod body volume for each of the geologic ages listed in the data table. Connect *all five* plots with a line. [1]
- 70 Identify, by name, *two* geologic periods when the brachiopods represented in the data table were living. [1]
- 71 State the names of the *two* brachiopod index fossils found in New York State bedrock. [1]
- 72 The earliest horses appeared in the Eocene epoch and were about the size of a large dog of today. Explain how the evolution of horses supports Cope's Rule. [1]
- 

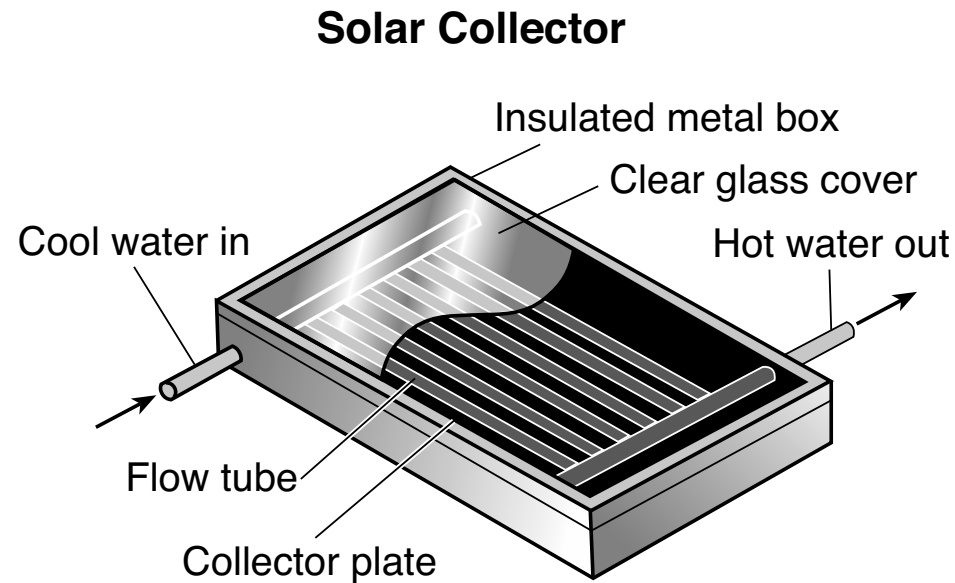
**GO RIGHT ON TO THE NEXT PAGE ➔**

Base your answers to questions 73 through 75 on the snowfall map in your answer booklet and on your knowledge of Earth science. The snowfall map shows some average yearly snowfall values, measured in inches, recorded for a portion of New York State. Some average yearly snowfall isolines have been drawn. Line *XY* is a reference line on the map. The cities of Watertown and Oswego are shown on the map.

- 73 On the map *in your answer booklet*, draw the 240-inch average yearly snowfall isoline. [1]
- 74 On the grid *in your answer booklet*, construct a profile of the average annual snowfall along line *XY* by plotting the value of each isoline that crosses line *XY*. Connect *all six* plots with a line to complete the profile. [1]
- 75 The diagram *in your answer booklet* represents an observer standing next to the side of a building. Using the scale shown, draw an **X** on the side of the building to represent the height of the greatest amount of average yearly snowfall that is indicated on the map. [1]
-



Base your answers to questions 76 through 78 on the diagram below and on your knowledge of Earth science. The diagram represents a cutaway view of a flat-plate solar collector used to heat water at a New York State location.



76 Identify the energy transfer process by which light travels through space from the Sun to the solar collector. [1]

77 Explain why the flow tubes and collector plate inside the solar collector are black in color. [1]

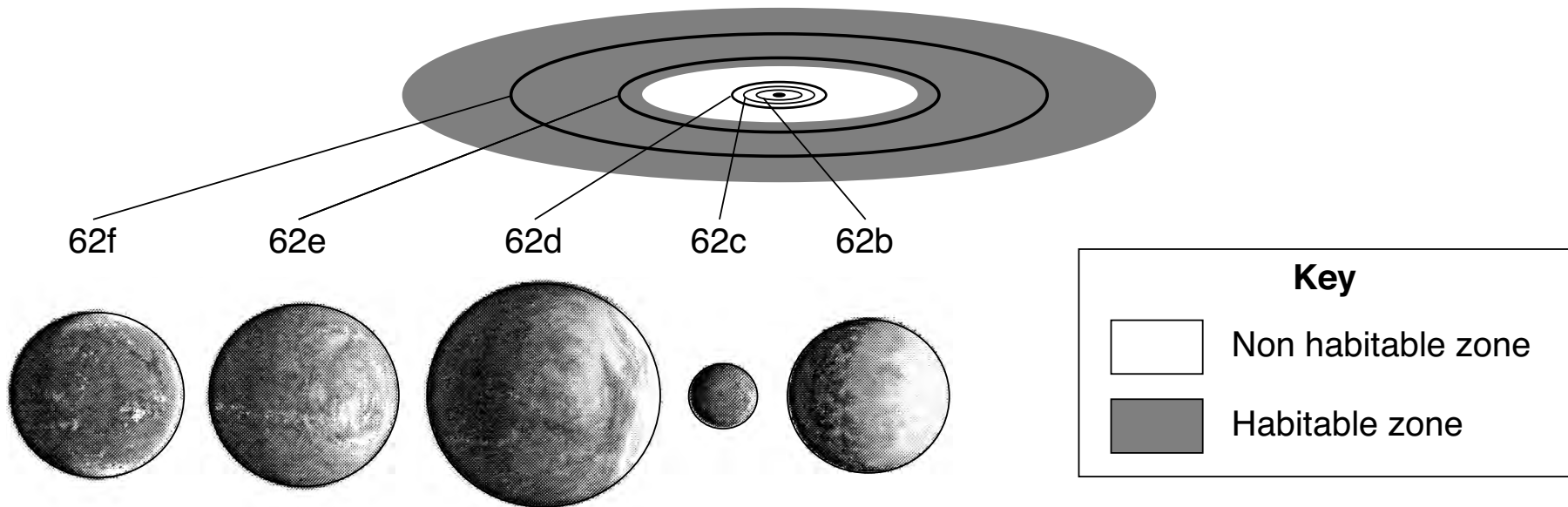
78 The glass cover on this solar collector allows visible light to enter the collector. Identify the type of electromagnetic energy emitted by the flow tubes and collector plate that is trapped inside the collector by the glass cover. Also, circle the relative wavelength of this trapped electromagnetic energy compared to wavelengths of visible light. [1]

Base your answers to questions 79 through 82 on the passage and diagram below, on the diagram and data table on the next page, and on your knowledge of Earth science. The diagrams compare the inner planets of our solar system to the planetary system surrounding the star *Kepler-62*, which is located in our galaxy. The data table shows some data for the planets in the *Kepler-62* system.

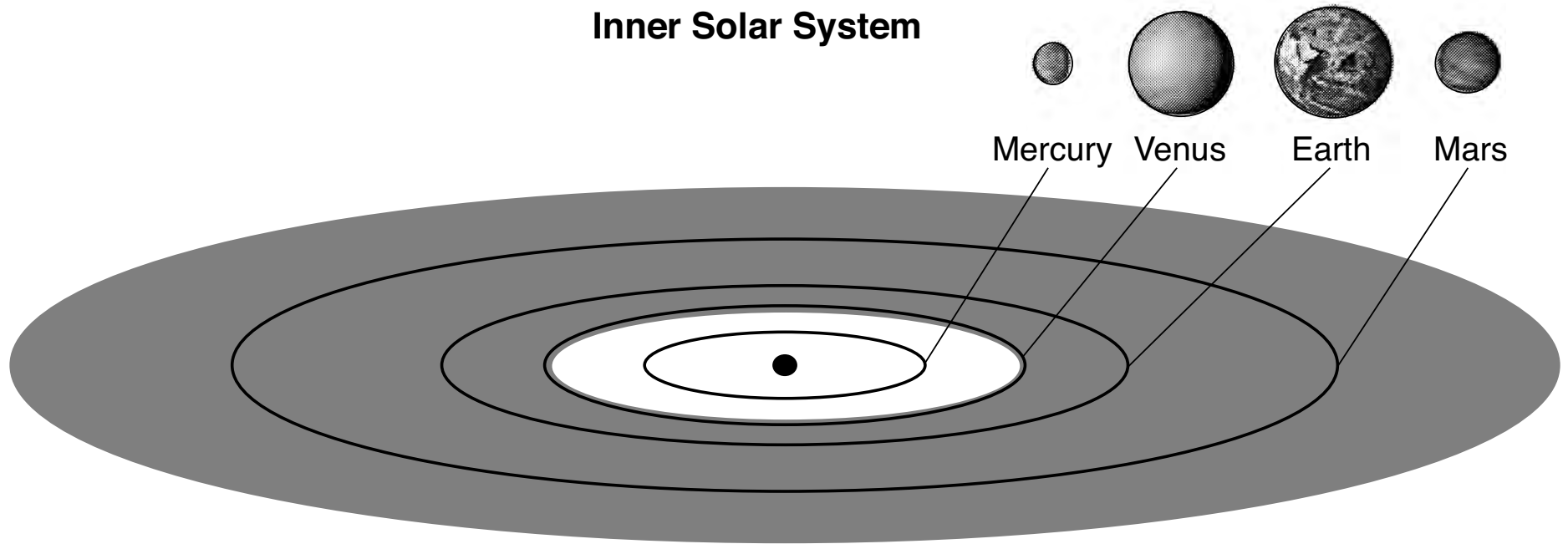
### ***Kepler-62* Planetary System**

Five planets orbit a seven-billion-year-old star, *Kepler-62*, which has a surface temperature of approximately 4900 Kelvin. Two of these planets are located within the habitable zone, which is the region around a star where life may exist due to the possible presence of water in the liquid phase. The shaded areas in the orbital diagrams below indicate the habitable zone of each system.

### ***Kepler-62* Planetary System**



## Inner Solar System



(Planets and orbits are drawn to scale)

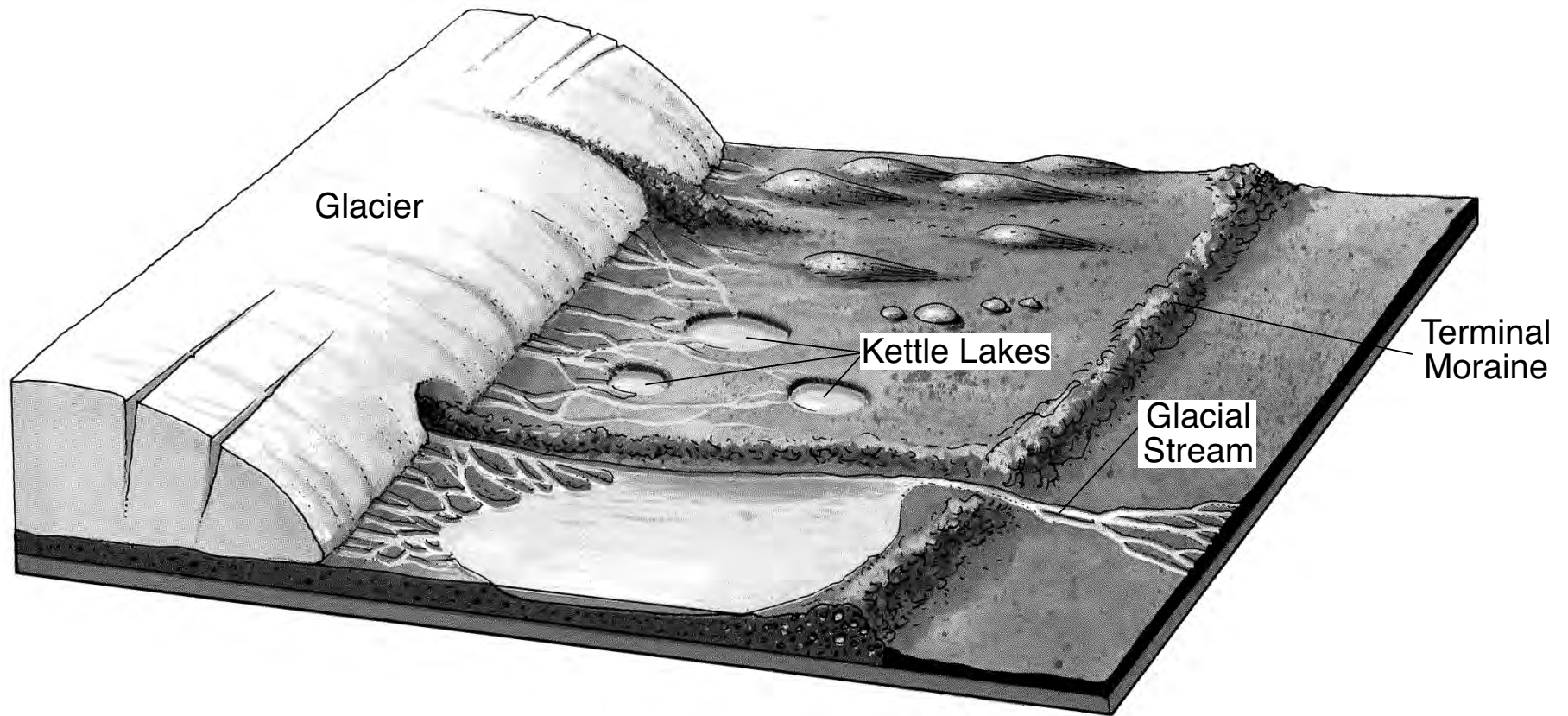
**Data Table**

<b>Name of Planet</b>	<b>Distance from <i>Kepler-62</i> (million kilometers)</b>	<b>Equatorial Diameter (compared to Earth's diameter)</b>
62b	8.23	1.31
62c	13.76	0.54
62d	17.95	1.95
62e	63.88	1.6
62f	107.41	1.4

- 79 Identify the name of the galaxy where the *Kepler-62* planetary system is located. [1]
- 80 Identify the name of the planet in our solar system that has an equatorial diameter most similar in size to the equatorial diameter of planet Kepler-62c. [1]
- 81 Identify the name of the planet in the *Kepler-62* planetary system that has the shortest period of revolution, and explain why this planet has the shortest period of revolution. [1]
- 82 Identify the names of the *two* planets in the *Kepler-62* planetary system that may have liquid water on their surfaces, and explain why these planets may have liquid water on their surfaces. [1]
-

**GO RIGHT ON TO THE NEXT PAGE ➡**

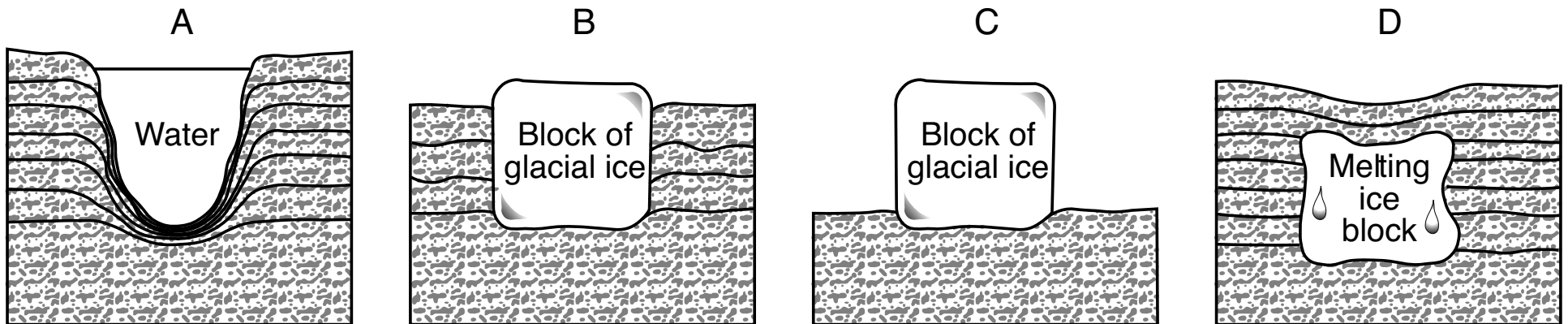
Base your answers to questions 83 through 85 on the block diagram below and on your knowledge of Earth science. The diagram represents glacial features formed by a continental glacier and its melt water.



83 Describe the arrangement of the sediments found within the terminal moraine, which marks the farthest advance of the glacier. [1]

84 The cross sections below, labeled A, B, C, and D, represent four stages in the development of a kettle lake. The stages are *not* shown in the correct order.

### Stages in Kettle Lake Formation



*In your answer booklet*, place the letters in the correct order to indicate the sequence of development of a kettle lake from earliest stage to latest stage. [1]

85 Terminal moraines found on Long Island were deposited during the advance and retreat of glacial ice during the last ice age. Identify, by name, the geologic epoch during which these moraines were deposited. [1]

---

