

Part A

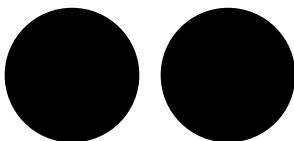
Answer all questions in this part.

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

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

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

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



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

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

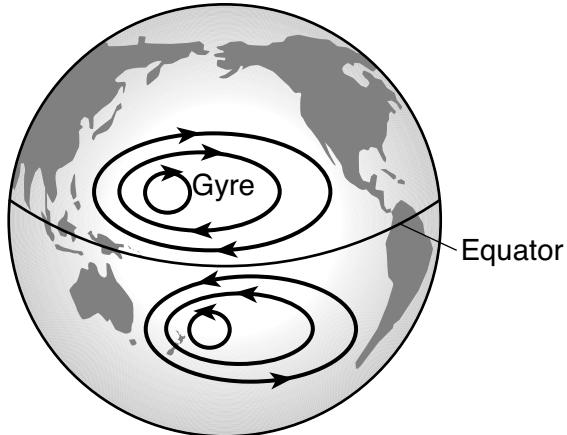
3 The motion of a Foucault pendulum provides evidence that Earth

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

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

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

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



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

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

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

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

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

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

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

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



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

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

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

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

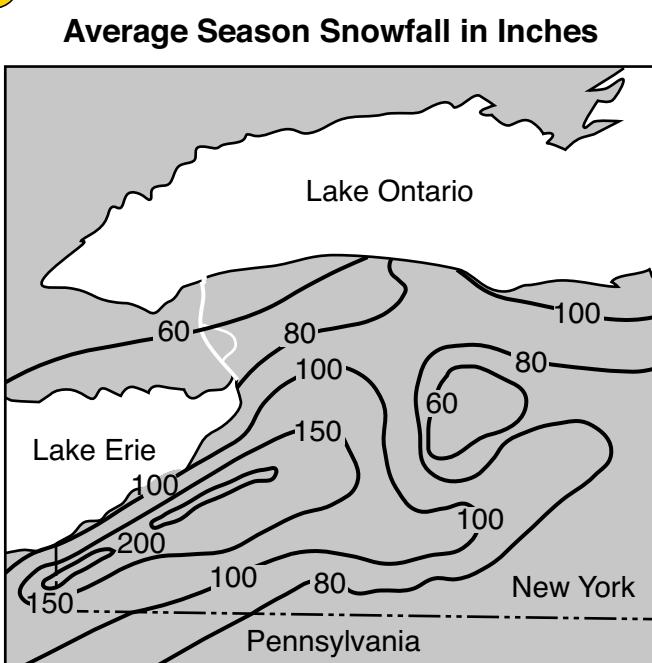


<http://dianajuncher.dk/>

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

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

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



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

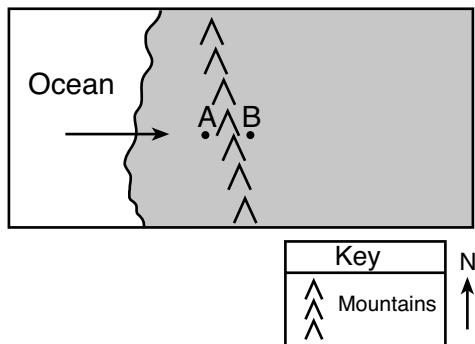
- 11 Which current has a warming effect on the climate of the southeast coast of Africa?

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

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

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

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



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

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

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

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

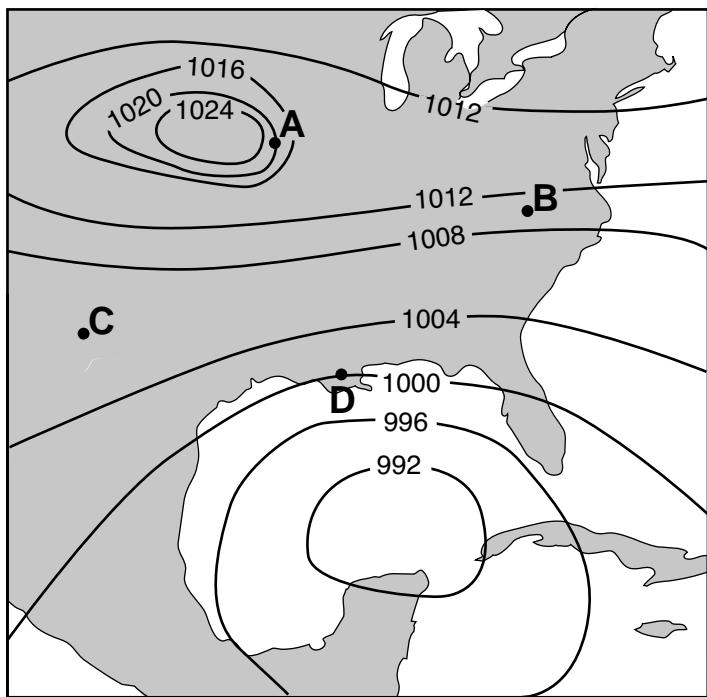
- 15 Scientists infer that oxygen first began to enter Earth's atmosphere after the appearance of

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

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

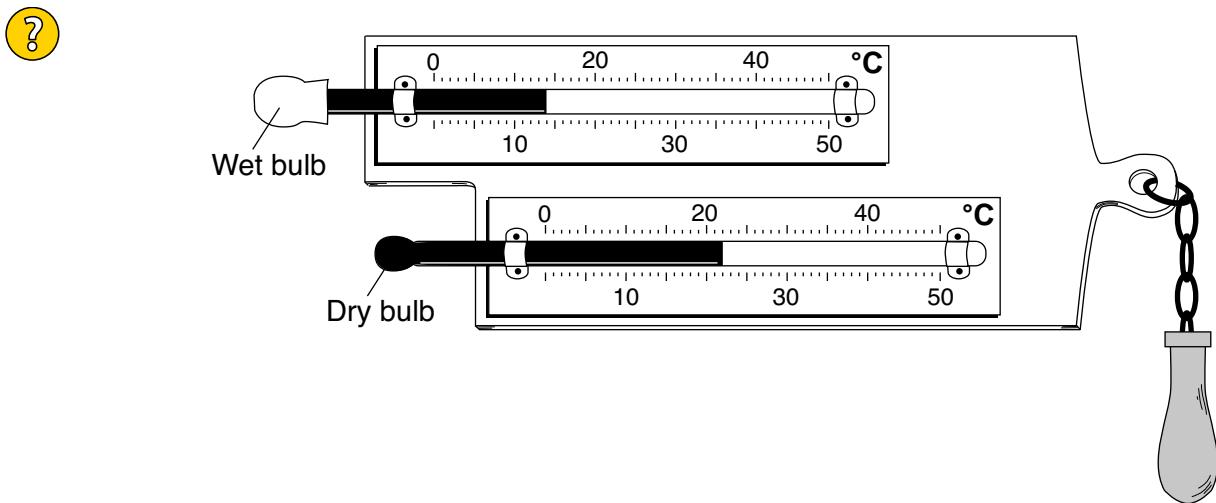
- (1) Tasman Hot Spot–Pacific Plate
 - (2) Canary Island Hot Spot–Eurasian Plate
 - (3) St. Helena Hot Spot–South American Plate
 - (4) Yellowstone Hot Spot–North American Plate

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



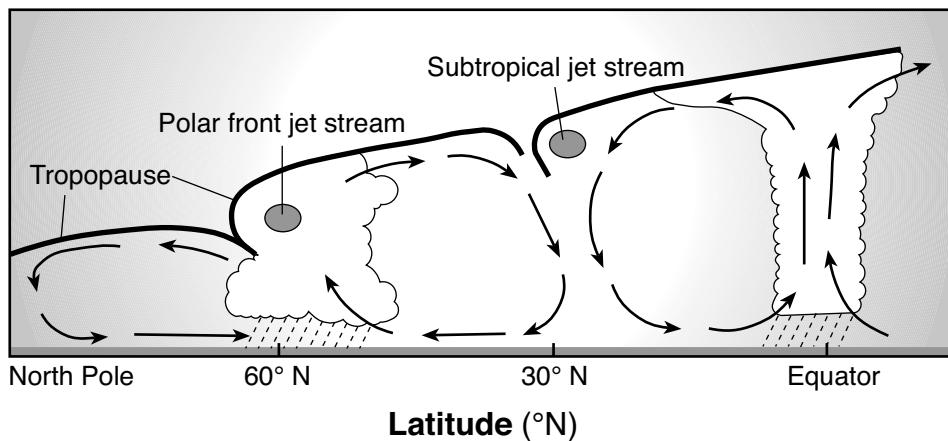
At which location is surface wind speed the *lowest*?

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



What is the relative humidity?

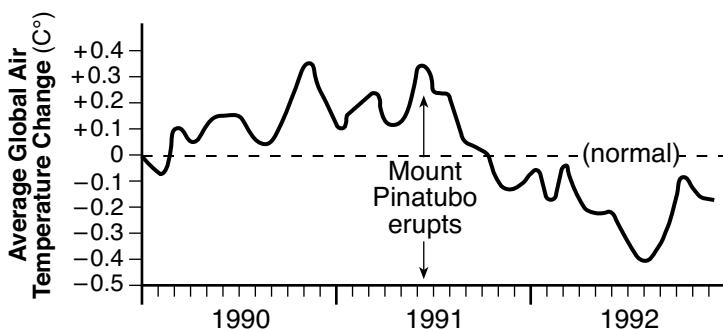
19 The diagram below shows the locations of the two major jet streams in Earth's atmosphere.



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

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

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



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

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

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

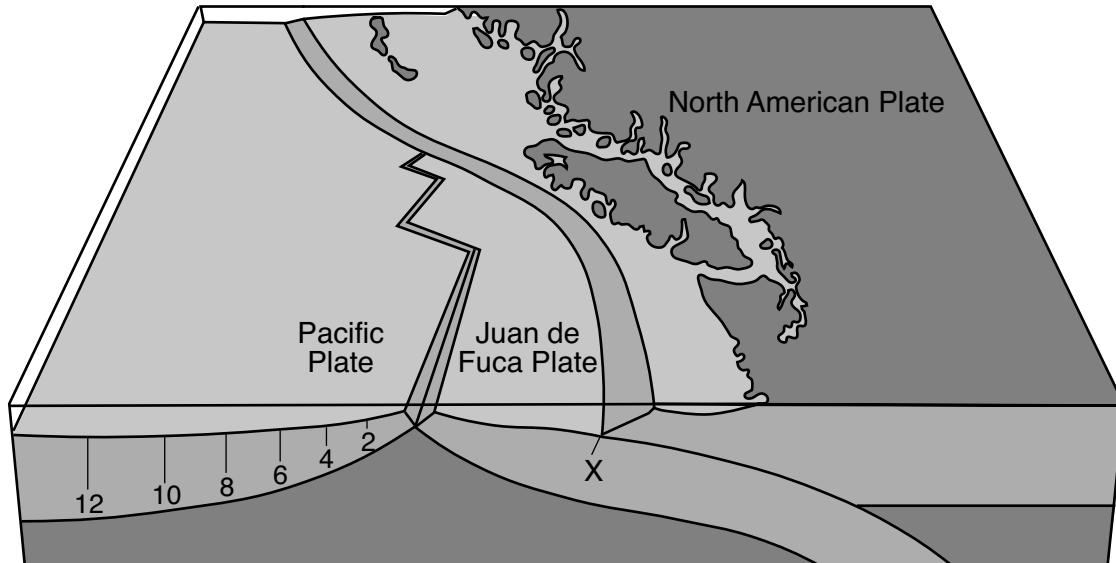
- 21 The map below shows the location of the Chicxulub crater, which was formed when a massive asteroid impacted Earth 65.5 million years ago.



Scientists infer that this impact contributed to the extinction of

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

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

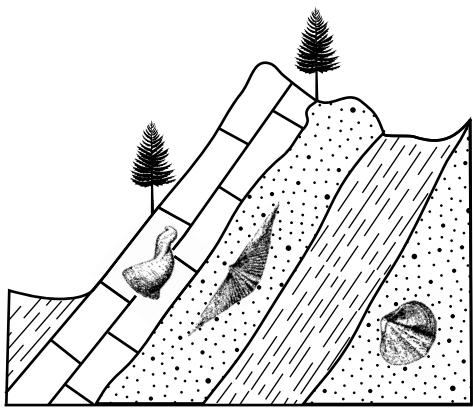


Adapted from: <http://mountainculturegroup.com/>

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

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

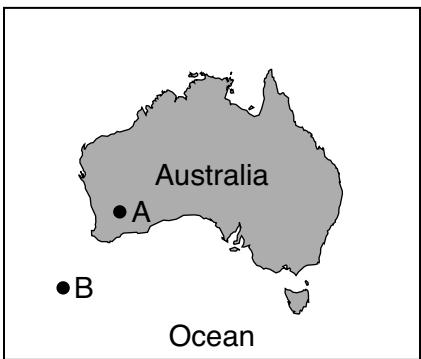
- 23 A cross section of Earth's crust is represented below. Index fossils are present in some of the rock layers.



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

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

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



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

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

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

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

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

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

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

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

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

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

- 29 A glacial moraine is best described as

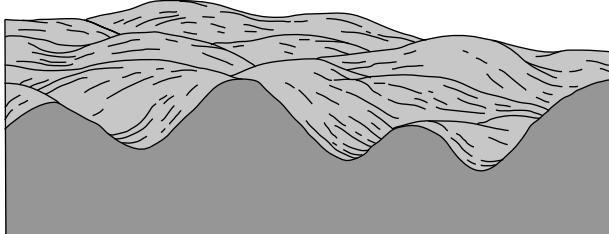
- (1) unsorted sediment directly deposited by a glacier
- (2) sorted sediment deposited as the glacier melts
- (3) a body of water formed by a retreating glacier
- (4) an elongated hill composed of sand and formed by a retreating glacier

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

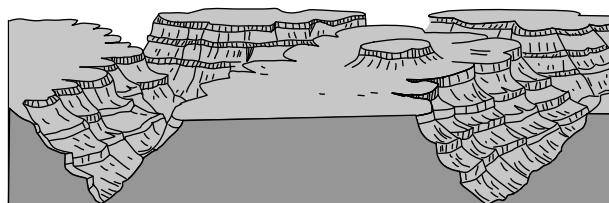
- (1) gneiss
- (2) marble
- (3) quartzite
- (4) schist

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

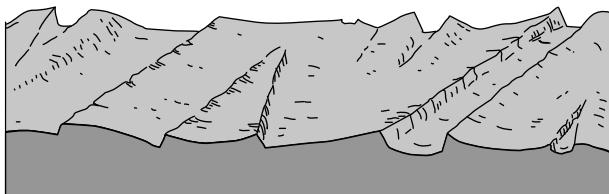
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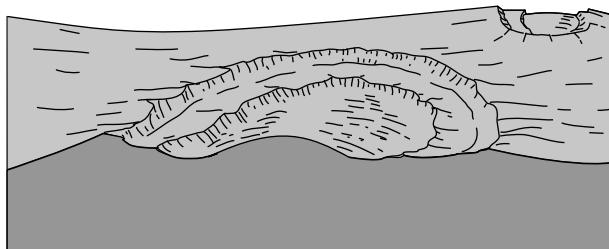
(1)



(3)



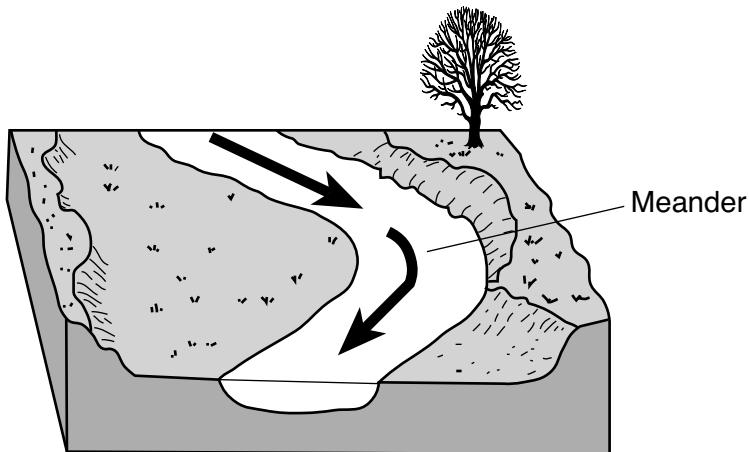
(2)



(4)

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

?



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

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

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

?

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

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

?



<http://fijisun.com.fj>

Which two factors most likely caused this landslide?

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

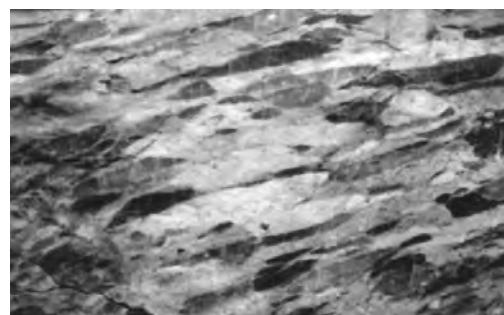
35 The two photographs below and the arrow between them show conglomerate and the processes that changed the conglomerate to rock X.

?



Conglomerate

→
Heat
and
pressure



Rock X

Rock X is most likely

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

Part B-1

Answer all questions in this part.

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

Base your answers to questions 36 through 38 on the passage and mineral table below and on your knowledge of Earth science. The table shows some properties of four minerals that display fluorescence.

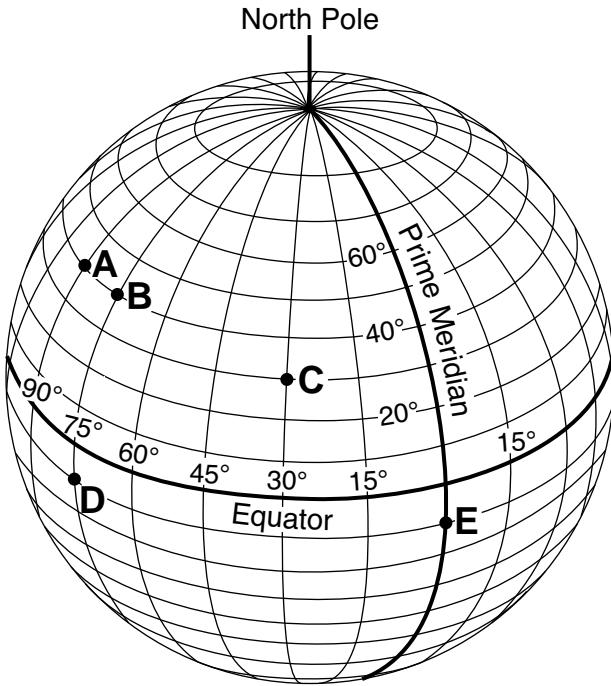
Fluorescent Minerals

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

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

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

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



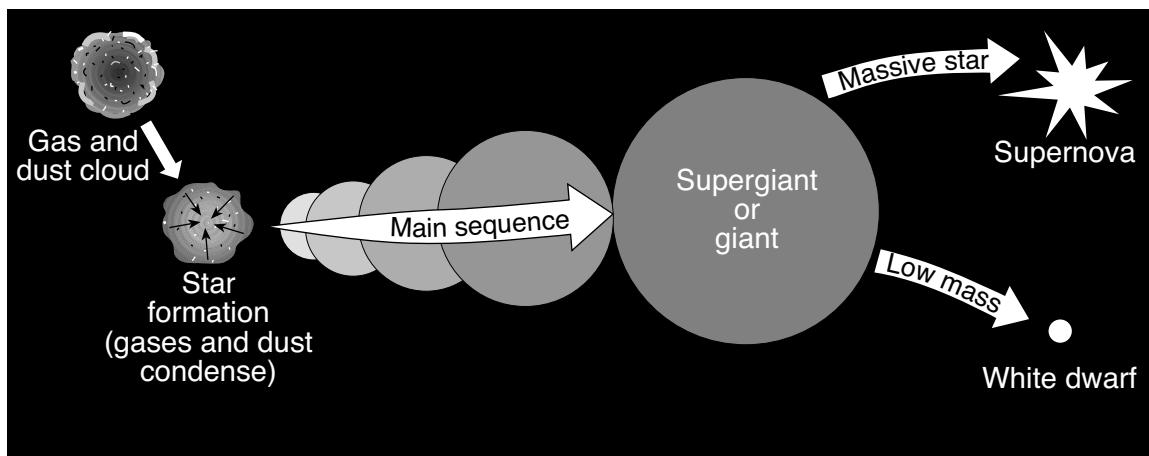
39 Which two locations have the same solar time?

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

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

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

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



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

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

42 Which star is most likely to become a supernova?

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

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

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

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

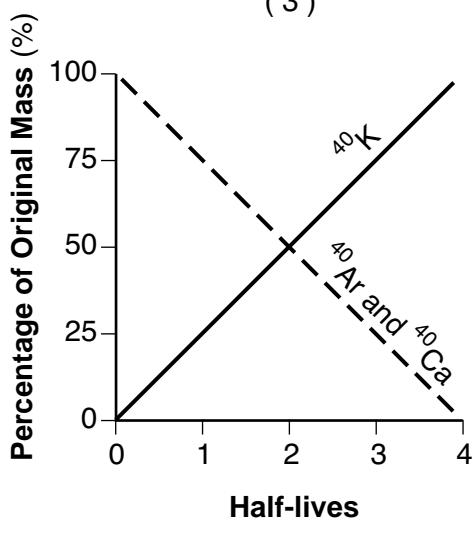
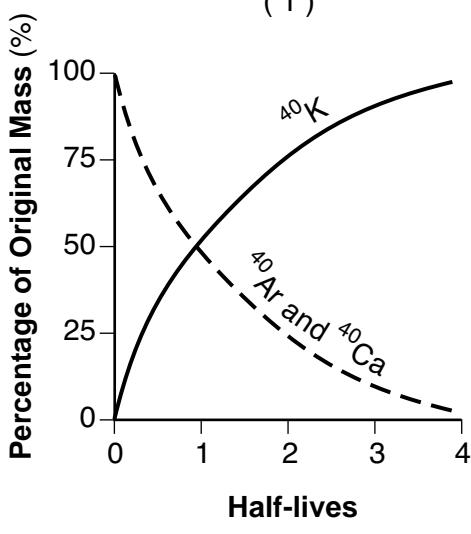
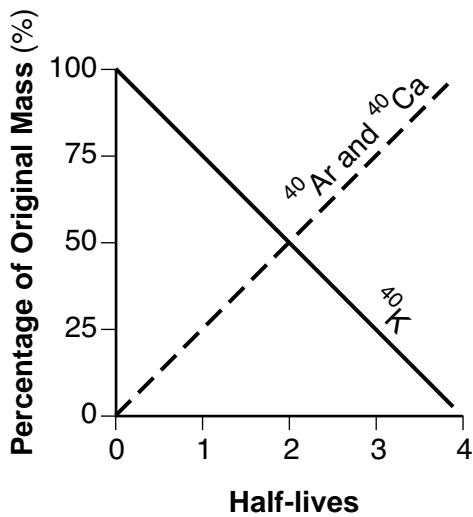
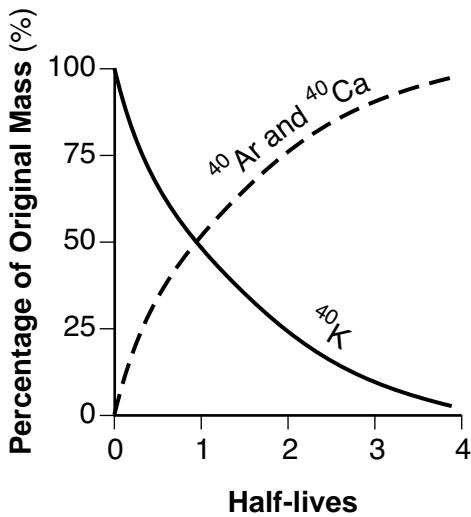
Radioactive Decay Data

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

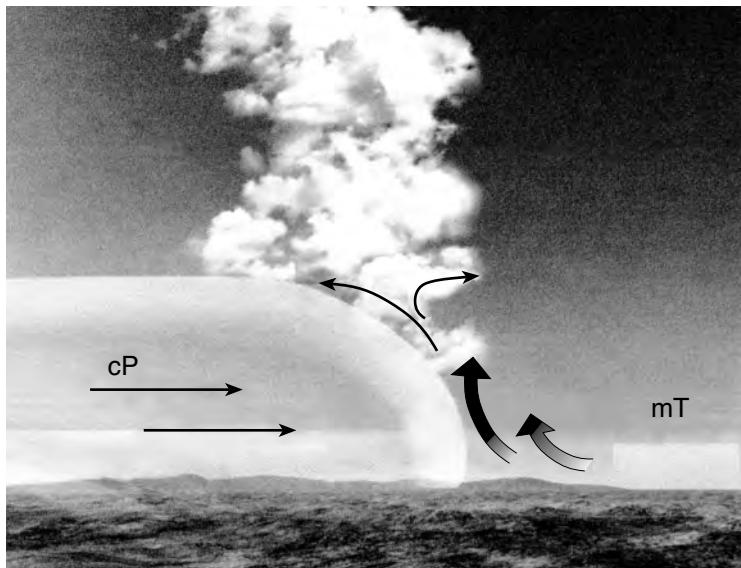
44 Which radioactive isotope takes the greatest amount of time to disintegrate?

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

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



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



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

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

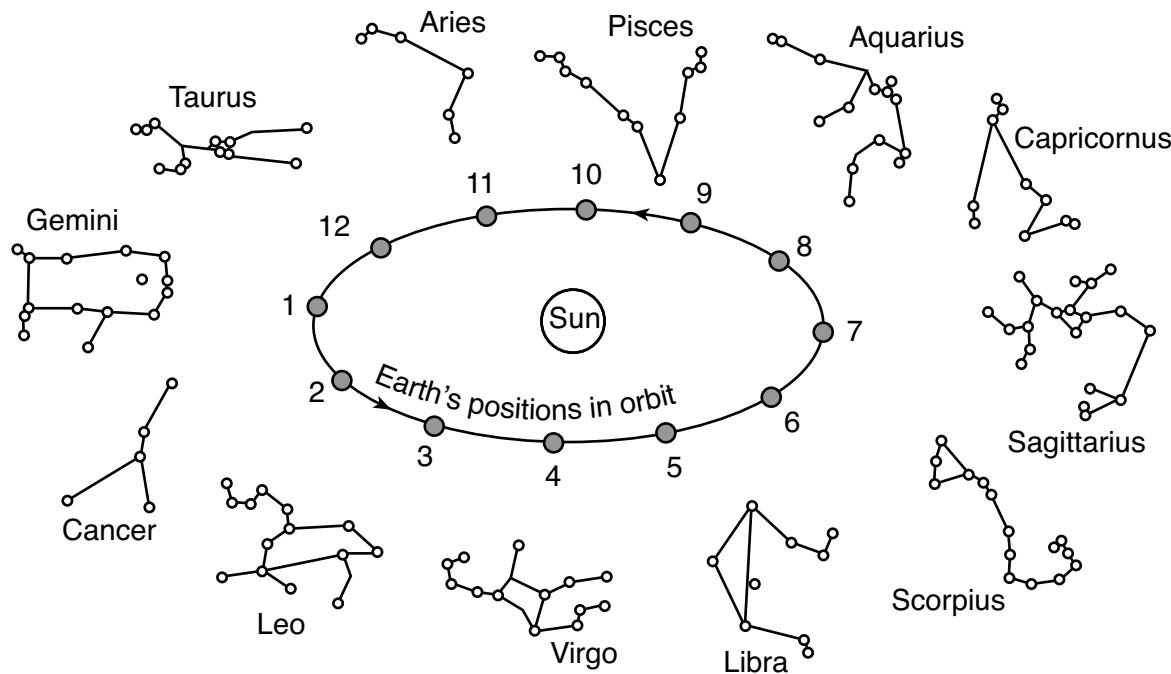
47 Clouds are forming along the front because the rising air is

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

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

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

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



(Not drawn to scale)

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

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

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

- ?**
- | | |
|--|---|
| <ol style="list-style-type: none"> (1) Aries (2) Capricornus | <ol style="list-style-type: none"> (3) Libra (4) Scorpius |
|--|---|
-