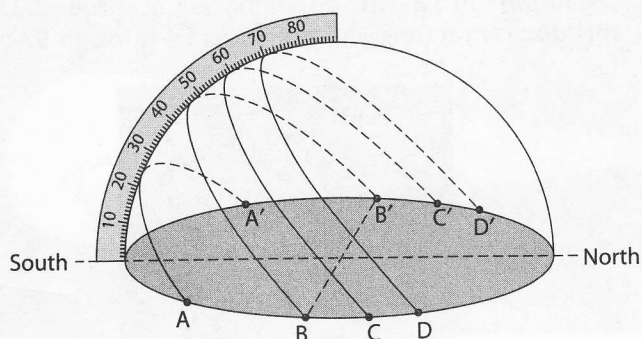## Directions

Review the Test-Taking Strategies section of this book. Then answer the following questions. Read each question carefully. Decide which choice is the correct answer.

Part A

Base your answers to questions 1 through 4 on the following diagram. The diagram represents a plastic hemisphere upon which lines have been drawn to show the apparent paths of the sun on four days at a location in New York State. Two of the days are December 21 and June 21. The protractor is placed over the north-south line.

1 On which two dates could the sun have followed path C-C'?
(1) October 22 and March 28
(2) September 9 and January 7
(3) January 27 and August 21
(4) May 7 and August 1

2 Which path was recorded on a day that had 12 hours of daylight and 12 hours of darkness?
(1) A-A'   (2) B-B'   (3) C-C'   (4) D-D'

3 Which would be the approximate length of daylight for the observer, when the sun travels along the entire length of path A-A'?
(1) 9 hours   (3) 15 hours
(2) 12 hours   (4) 18 hours

4 Which observation about the sun's apparent path on June 21 is best supported by the diagram?
(1) The sun appears to move across the sky at a rate of 1° per hour.
(2) The sun's total daytime path is shortest on this date.
(3) Sunrise occurs north of east.
(4) Sunset occurs south of west.

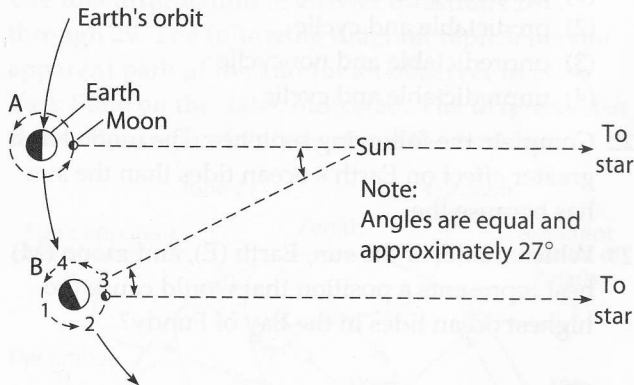**5** Which motion causes the apparent rising and setting of the moon each day as seen from a location in New York State?
(1) Earth revolving around the sun
(2) the moon revolving around Earth
(3) Earth rotating on its axis
(4) the moon rotating on its axis

6 As Earth revolves in orbit from its January position to its July position, the angle between its axis and orbital plane will
(1) decrease
(2) increase
(3) remain the same

7 The following diagram represents a Foucault pendulum in a building in New York State. Points A and A' are fixed points on the floor.
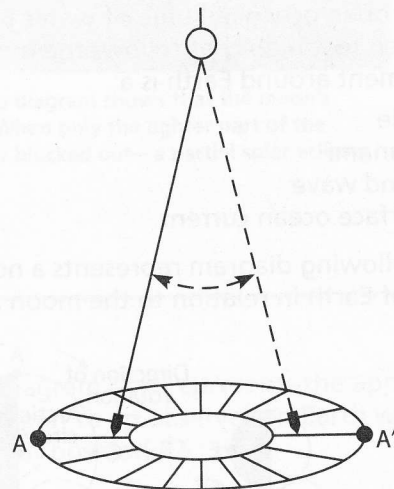
As the pendulum swings for six hours, it will
(1) appear to change position due to Earth's rotation
(2) appear to change position due to Earth's revolution
(3) continue to swing between A and A' due to inertia
(4) continue to swing between A and A' due to air pressure

Base your answers to questions 8 through 12 on the following diagram.

Earth's orbit

Earth
Moon
A

Sun — — — — — — To star

Note:
Angles are equal and approximately 27°

B 4
1 3
2

To star

8 Earth will travel from A to B in
   (1) 1 day   (3) $27\frac{1}{3}$ days
   (2) 2.5 days   (4) $29\frac{1}{2}$ days

9 In respect to Earth at position B, in which phase is the moon?
   (1) full   (3) gibbous
   (2) new   (4) crescent

10 When Earth is at position B, how long must the moon travel beyond where it is shown to be in the same phase as it was in position A?
   (1) 1 day   (3) 6 hours
   (2) 2 days   (4) 7 days

11 What is the main reason why the moon must travel a greater distance to be in the same phase at position B as it was at position A?
   (1) The sun's rays are essentially parallel when they reach Earth.
   (2) The moon's periods of revolution and rotation are the same.
   (3) Earth is constantly revolving around the sun.
   (4) Earth's axis is inclined to the plane of its orbit.

12 At position B, the highest tides on Earth will occur when the moon is at points
   (1) 1 and 2   (3) 2 and 4
   (2) 1 and 3   (4) 3 and 4

13 The Coriolis effect provides evidence that Earth
   (1) has a magnetic field
   (2) has an elliptical orbit
   (3) revolves around the sun
   (4) rotates on its axis

14 A projectile is launched from a point near the North Pole toward the equator. Which diagram best represents the apparent path of the projectile, if it were viewed from Earth?

North Pole
Equator
(1)

North Pole
Equator
(3)

North Pole
Equator
(2)

North Pole
Equator
(4)
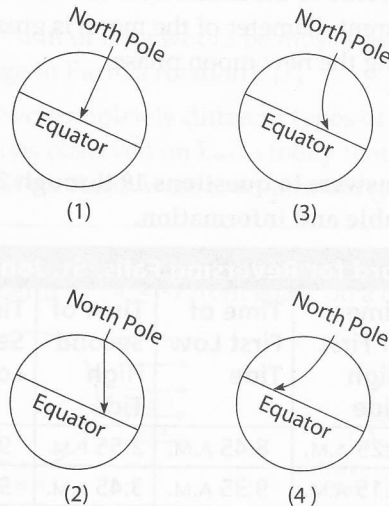
15 Some stars that can be seen in New York State on a summer night cannot be seen on a winter night. This fact is a result of the
   (1) rotation of Earth on its axis
   (2) rotation of the stars around Polaris
   (3) revolution of Polaris around Earth
   (4) revolution of Earth around the sun

16 To an observer on Earth, the planet Venus does not appear at one fixed position among the stars because Venus
   (1) rotates on its axis
   (2) revolves around the sun
   (3) shows an apparent motion around Earth
   (4) shows a complete cycle of phases

17 The diagram below shows the rotation of Earth as it would appear from a satellite over the North Pole. The time at point X is closest to

Point X
North pole
Sun's rays
Direction of rotation
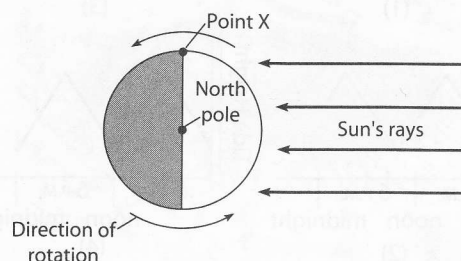
   (1) 6 A.M.   (3) 6 P.M.
   (2) 12 noon   (4) 12 midnight

18 The new moon phase occurs when the moon is positioned between Earth and the sun. However, these positions do not always cause an eclipse of the sun because the
(1) moon's orbit is tilted relative to Earth's orbit
(2) new moon phase is visible only at night
(3) night side of the moon faces toward Earth
(4) apparent diameter of the moon is greatest during the new moon phase

Part B

Base your answers to questions 19 through 23 on the following table and information.

Tidal Record for Reversing Falls, St. John River				
Date	Time of First High Tide	Time of First Low Tide	Time of Second High Tide	Time of Second Low Tide
June 26	2:25 A.M.	8:45 A.M.	2:55 P.M.	9:05 P.M.
June 27	3:15 A.M.	9:35 A.M.	3:45 P.M.	9:55 P.M.
June 28	4:05 A.M.	10:25 A.M.	4:35 P.M.	10:45 P.M.

The Bay of Fundy, located on the east coast of Canada, has the highest ocean tides in the world. The St. John River enters the Bay of Fundy at the city of St. John, where the river actually reverses direction twice a day at high tides. Data for the famous Reversing Falls of the St. John River are given for high and low tides on June 26–28, 1994.

**19** Which graph best represents the tides recorded on June 28?
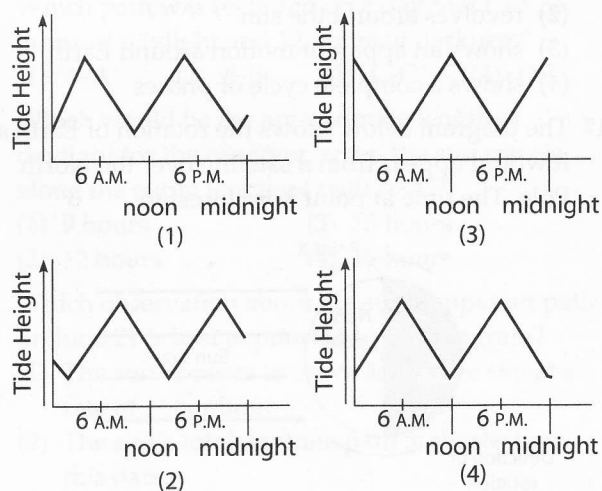
**20** Compared to the first high tide on June 26, how much later in the day did the first high tide occur on June 27? [1]

21 Tides in the Bay of Fundy are best described as
(1) predictable and noncyclic
(2) predictable and cyclic
(3) unpredictable and noncyclic
(4) unpredictable and cyclic

22 Complete the following sentence: The moon has a greater effect on Earth's ocean tides than the sun has because the

23 Which model of the sun, Earth (E), and moon (M) best represents a position that would cause the highest ocean tides in the Bay of Fundy?
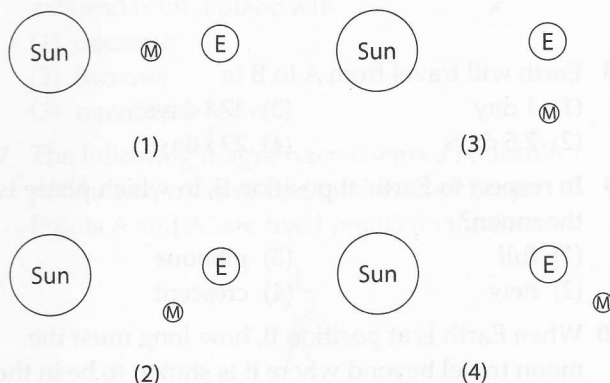

24 On the United States time zone map provided below, indicate the standard time in *each* time zone when it is 9 A.M. in the Central Time Zone. The dashed lines represent the standard time meridians for each time zone. Be sure to indicate the time for all *three* zones.
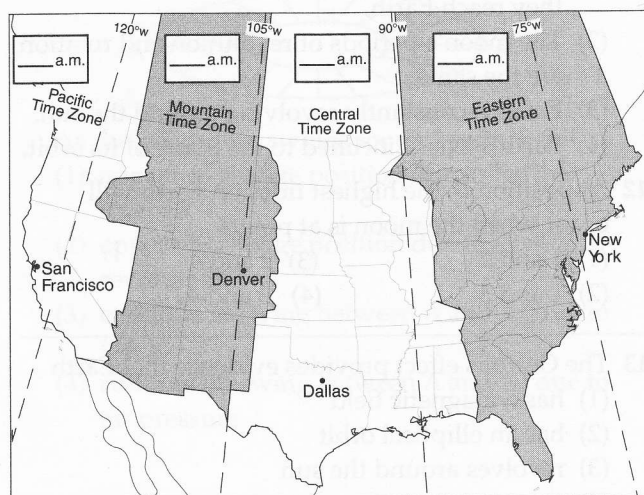
25 Draw and fully label a diagram showing a total eclipse of the sun. Include labels for the shadows, all solar system members shown, and phase of the moon. [4]

Use this information to answer questions 26 through 29. The following diagram represents the apparent path of the sun for an observer in New York State on the dates indicated. The diagram also shows the angle of Polaris above the horizon.

(Not drawn to scale)
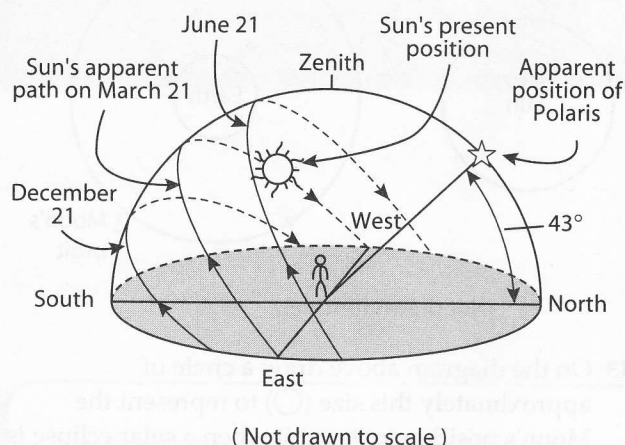
26 On the diagram, draw the apparent path of the sun on May 21. [1]

27 On the diagram, mark and label the position of sunrise on May 21. [1]

28 State the latitude of the location represented by the diagram to the nearest degree. Include the latitude direction in your answer. [1]

29 At approximately what hour of day would the sun be at the position shown in the diagram? [1]

Part C

**Using the following statement, answer questions 30 through 33.**

Suppose that Earth does not have and has never had a moon.

30 Why would Earth still have ocean water tides? [1]

31 How would Earth's ocean tides be different than they are with the presence of the moon? [1]

32 Would people on Earth experience lunar and/or solar eclipses? Explain why or why not. [2]

33 Infer how the lack of a moon would have affected time keeping throughout the history of humans. What specific time period would have been affected? [1]

Using the following statement, answer questions 34 and 35.

Through accurate measurements of time and studies of growth patterns of fossil life forms, it has been determined that Earth's rate of rotation is slowing down.

34 What unit of time would be most altered by this change in Earth's rotation? [1]

35 List two completely different types of apparent motions observed on Earth today that would not exist if the Earth were to stop rotating. [2]

36 The diagram provided below represents the Sun and Earth as viewed from space on a certain date.

(Not drawn to scale)
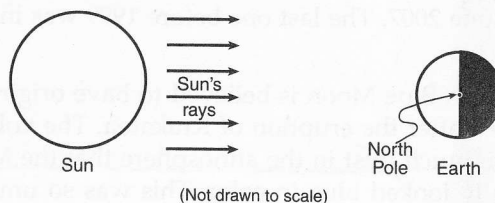
(a) Using a symbol for the Moon of approximately this size (◯), draw the position of the Moon on the diagram provided *above* at the time when the full-Moon phase is observed from Earth. [1]

(b) Draw an arrow on the diagram provided *above* that shows the Earth motion that causes surface ocean currents and surface winds to curve (Coriolis effect). [1]

37 The drawing below shows the mile wide Barringer impact crater located in Diablo Canyon, Arizona. Describe the event that produced this crater. [1]
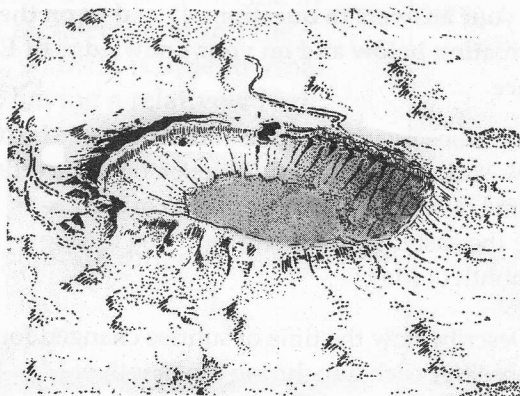
Base your answers to questions 38 through 40 on the reading passage below and on your knowledge of Earth science.

The Blue Moon

A "Blue moon" is the name given to the second full moon in a calendar month. Because there are roughly 29.5 days between full moons, it is unusual for two full moons to "fit" into a 30 or 31 day month (and impossible to fit into a 28 or 29 day month, so February can never have a Blue Moon). The saying "Once in a Blue Moon" means a rare occurrence, and predates the current astronomical use of the term, which is quite recent. In fact, Blue Moons are not all that rare, on average there will be one Blue Moon every 2.5 years. After 1999, the next Blue Moons will be in November 2001; July 2004; and June 2007. The last one before 1999 was in July 1996.

The term Blue Moon is believed to have originated in 1883 after the eruption of Krakatoa. The volcano put so much dust in the atmosphere that the Moon actually looked blue in color. This was so unusual that the term "once in a Blue Moon" was coined.

"The Blue Moon"
David R. Williams
nssdc. gsfc.nasa.gov/planetary/lunar/blue_moon.html

38 Explain why a Blue Moon never occurs during the month of February. [1]

39 What is the greatest number of full-Moon phases, visible from Earth, that are possible in a span of 1 year? [1]

40 Draw the relative positions of Earth, the Moon, and the Sun, as viewed from space, so that a full-Moon phase would be visible to an observer on Earth. Label Earth, the Moon, and the Sun in your drawing. [1]

Base your answers to questions 41 and 42 on the information below and on your knowledge of Earth science.

Accurate observations of the Sun were made by a New York State observer. This person observed the time of sunrise and the position of sunrise along the eastern horizon for each day during the month of May.

41 Describe how the time of sunrise changed for the observer each day during the month of May. [1]

42 State the actual Earth motion that causes the Sun to appear to rise each day. [1]

Base your answer to questions 43 through 45 on the diagram provided below and on your knowledge of Earth science. The diagram shows the Sun, Earth, and the Moon's orbit around Earth as viewed from space.
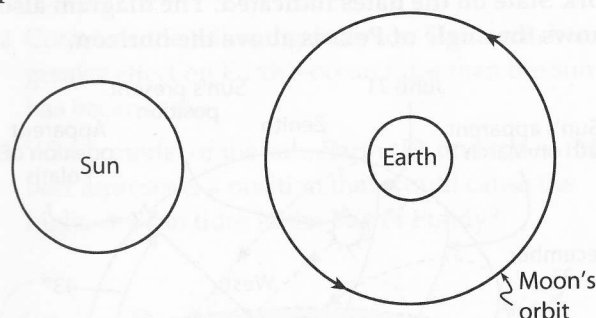
(Not drawn to scale)

43 On the diagram above draw a circle of approximately this size (○) to represent the Moon's position in its orbit when a solar eclipse is viewed from Earth. [1]

44 Approximately how many complete revolutions does the Moon make around Earth each month? [1]

45 Explain why solar eclipses do not occur every time the Moon revolves around Earth. [1]

Base your answers to questions 46 and 47 on the data table below, which provides information about four of Jupiter's moons.

Data Table			
Moons of Jupiter	Density (g/cm^3)	Diameter (km)	Distance from Jupiter (km)
Io	3.5	3630	421,600
Europa	3.0	3138	670,900
Ganymede	1.9	5262	1,070,000
Callisto	1.9	4800	1,883,000

46 Identify the planet in our solar system that is closest in diameter to Callisto. [1]

47 In 1610, Galileo was the first person to observe, with the aid of a telescope, these four moons orbiting Jupiter. Explain why Galileo's observation of this motion did *not* support the geocentric model of our solar system. [1]