

# EARTH'S MOTIONS

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1. Which hot spot location on Earth's surface usually receives the greatest intensity of insolation on June 21?

- A Iceland      B Hawaii      C Easter Island      D Yellowstone

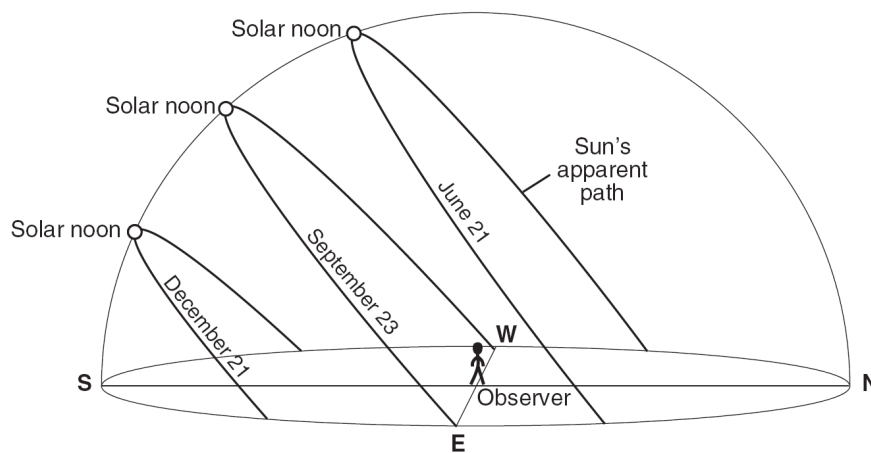
2. The Coriolis effect is a result of Earth's

- A tilted axis      B orbital shape      C revolution      D rotation

3. The best evidence that Earth rotates is provided by the

- A location of mid-oceanic ridge volcanoes and the distribution of index fossils  
B movement of Foucault pendulums and the Coriolis effect on air movement  
C pattern of changing seasons and the depth of meteor impacts  
D rate of uranium-238 decay and changes in atmospheric composition

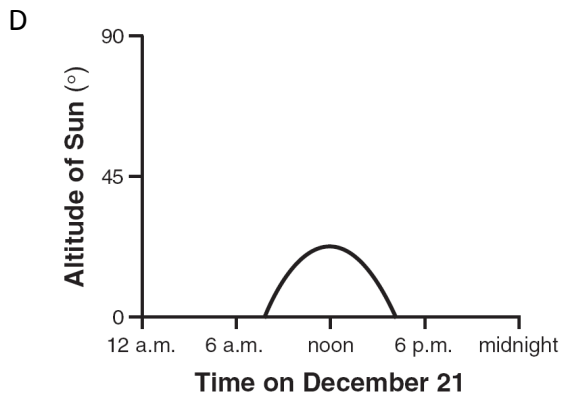
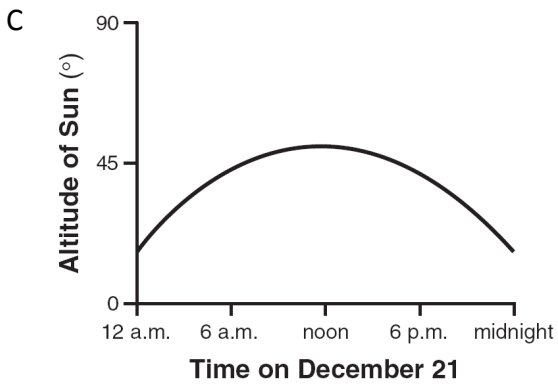
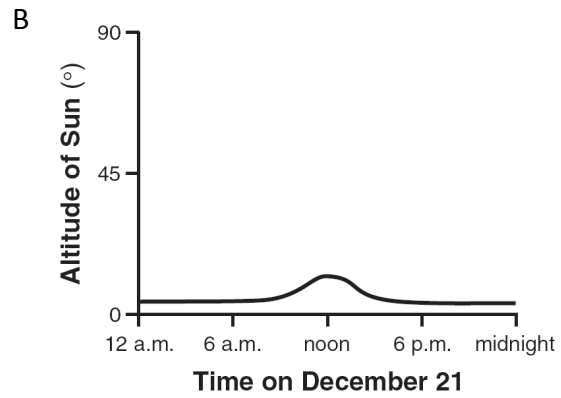
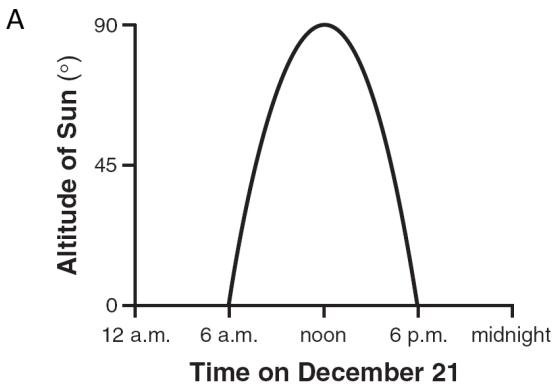
Base your answers to questions 4 through 7 on diagram below, which represents the Sun's apparent paths and the solar noon positions for an observer at 42° N latitude on December 21, September 23, and June 21.



4. In which direction will sunrise occur on June 21?

- A north of due west      B north of due east  
C south of due west      D south of due east
-

5. Which graph best shows the altitude of the Sun, as measured by the observer located at  $42^{\circ}$  N, at various times on December 21?



6. How many hours occurred between sunrise and solar noon on September 23?

A 6

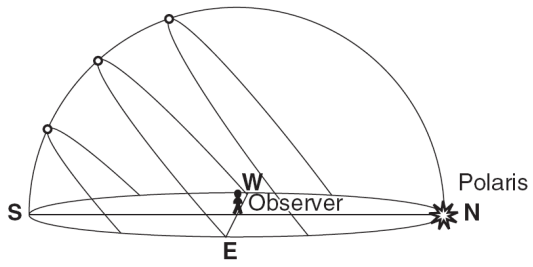
B 8

C 12

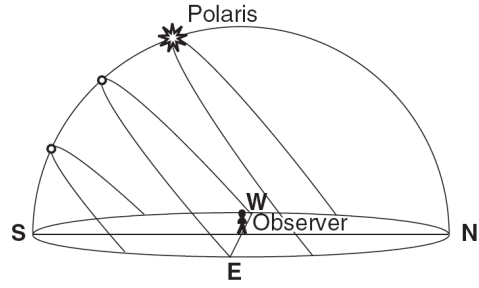
D 24

7. Which diagram best shows the location of *Polaris* relative to the observer?

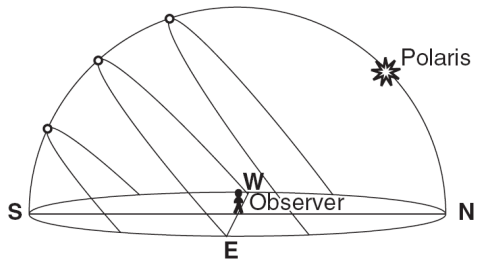
A



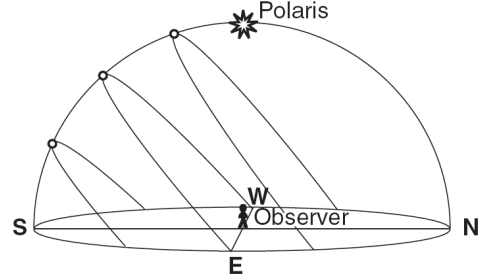
B



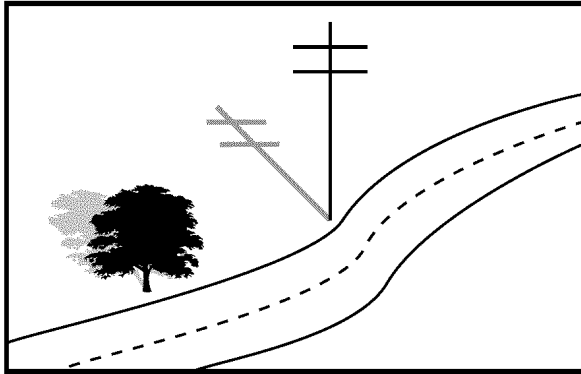
C



D

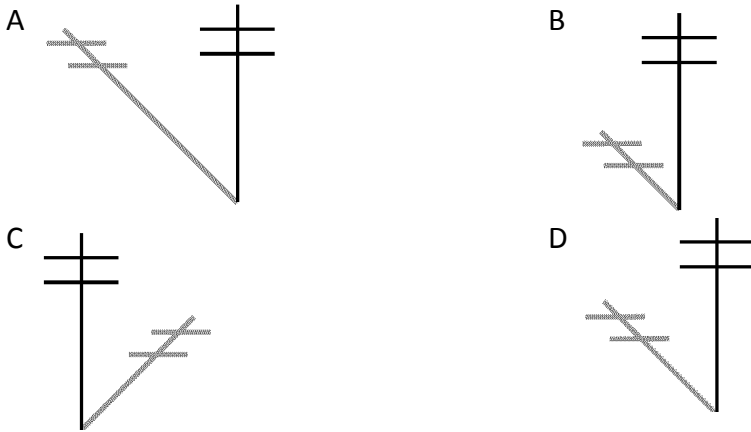


8. The diagram below shows the shadow cast by a telephone pole on March 21 at solar noon at a location in New York State.

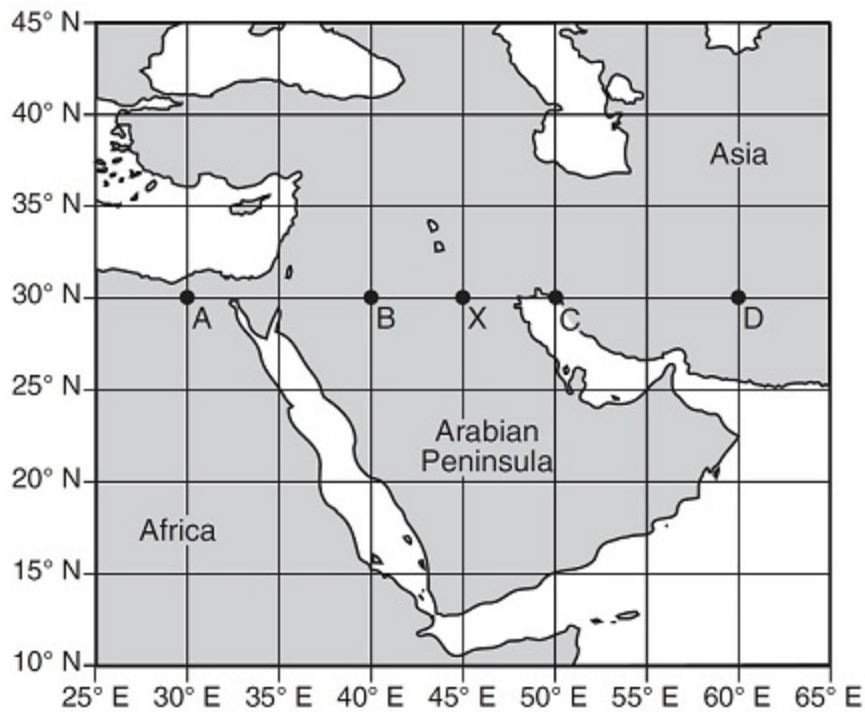


**Shadow Cast on March 21**

Which shadow was cast by the same telephone pole on June 21 at solar noon?



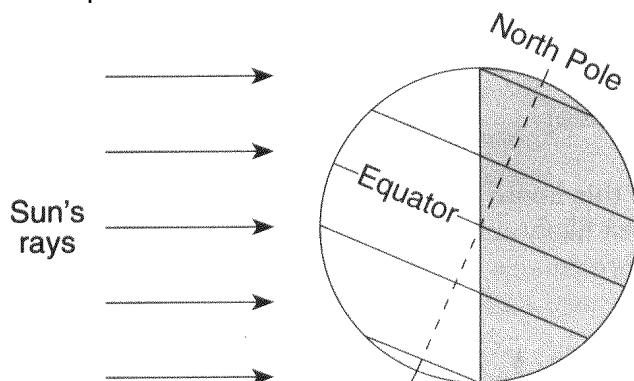
9. The map below shows a portion of the Middle East. Points *A*, *B*, *C*, *D*, and *X* are locations on Earth's surface.



When it is 10:00 a.m. solar time at location *X*, at which location is 11:00 a.m. solar time being observed?

- A *A*                      B *B*                      C *C*                      D *D*

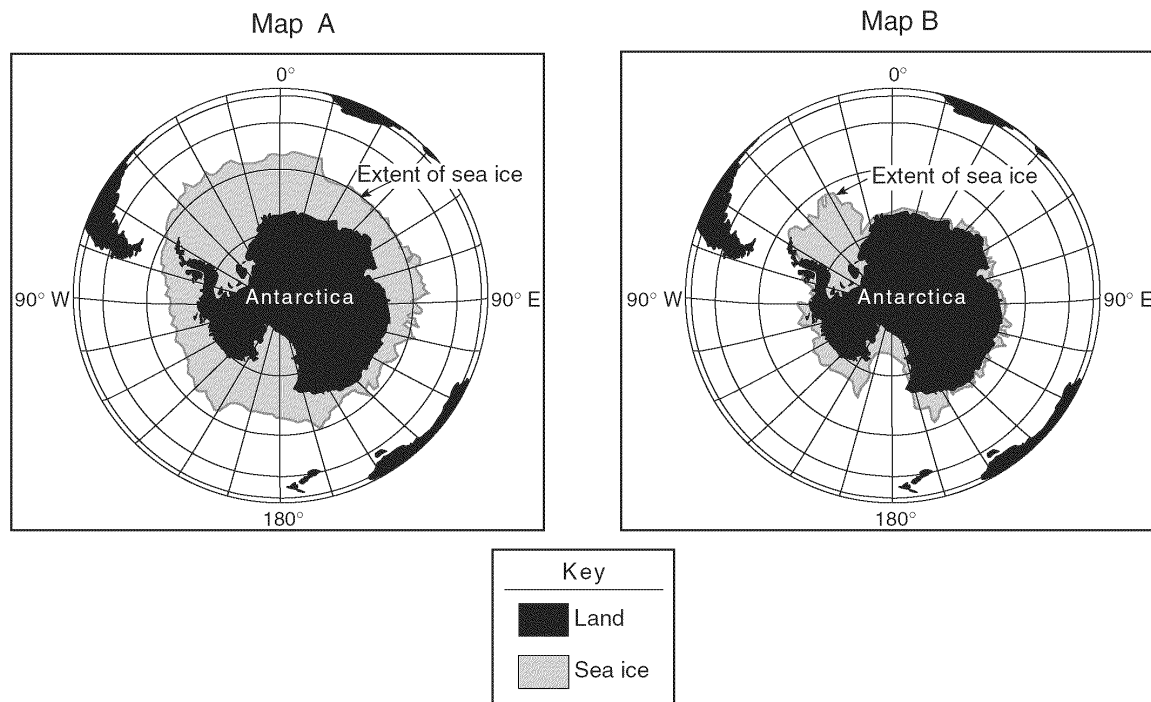
10. The diagram below shows Earth on a particular day in its orbit around the Sun. The dashed line represents Earth's axis.



Which date is represented by the diagram?

- A March 21              B June 21              C September 23      D December 21

11. The maps below show the amount of sea ice surrounding the continent of Antarctica at two different times of the year. Map *A* represents late August when the area covered by sea ice approaches its greatest extent. Map *B* represents the minimum extent of sea ice.

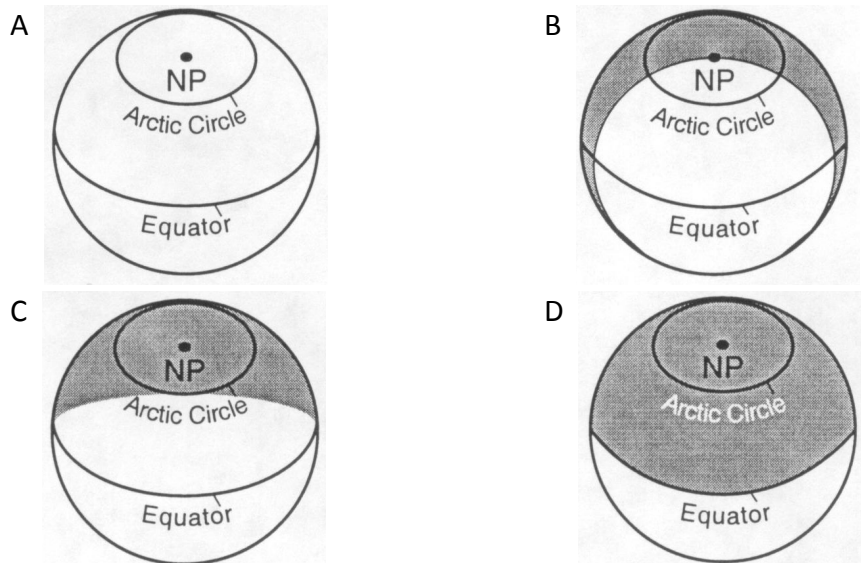


Which month is most probably represented by map *B*?

- A February      B May      C June      D October

12. Which diagram most correctly shows the portion of Earth that is illuminated by sunlight and the portion that is in shadow on the first day of summer in the Northern Hemisphere?

[Key: = illuminated, = shadow, NP = North Pole]



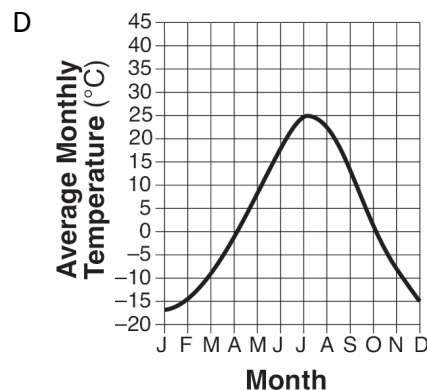
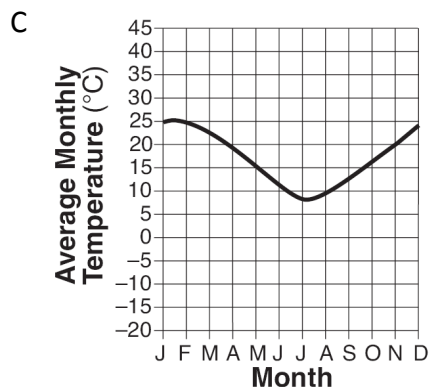
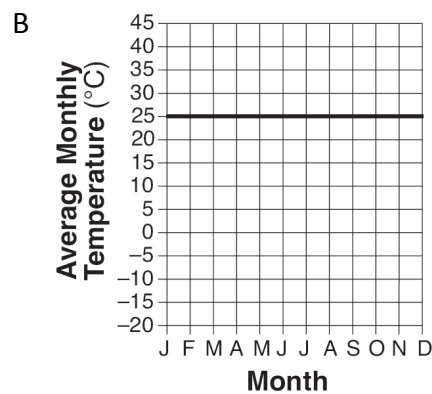
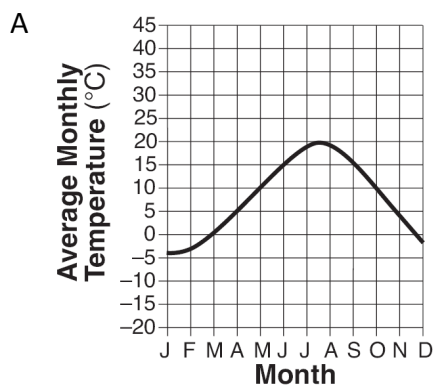
13. Based on observations made in the Northern Hemisphere, which statement is the best supporting evidence that the Earth rotates on its axis?

- A The stars appear to follow daily circular paths around Polaris.
- B The apparent solar diameter varies throughout the year.
- C The length of the daylight period varies throughout the year.
- D The seasons (spring, summer, fall, and winter) repeat in a cyclic pattern.

14. Seasonal changes on Earth are primarily caused by the

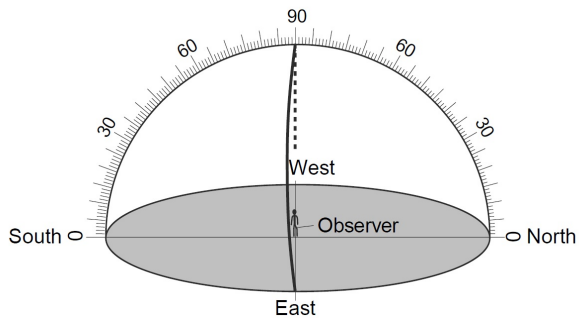
- A parallelism of the Sun's axis as the Sun revolves around Earth
- B changes in distance between Earth and the Sun
- C elliptical shape of Earth's orbit around the Sun
- D tilt of Earth's axis as Earth revolves around the Sun

15. Which graph best represents the average monthly temperatures for one year at a location in the Southern Hemisphere?

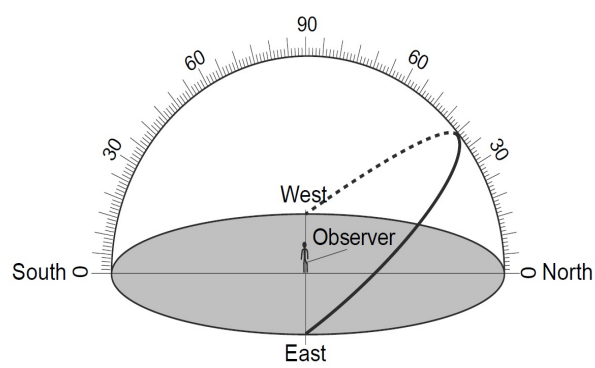


16. Which diagram represents the apparent path of the Sun on March 21 for an observer at the equator?

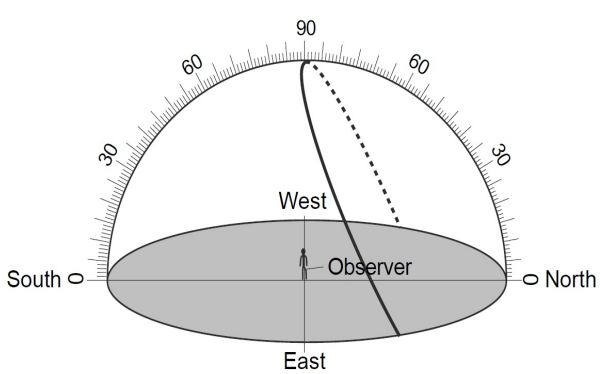
A



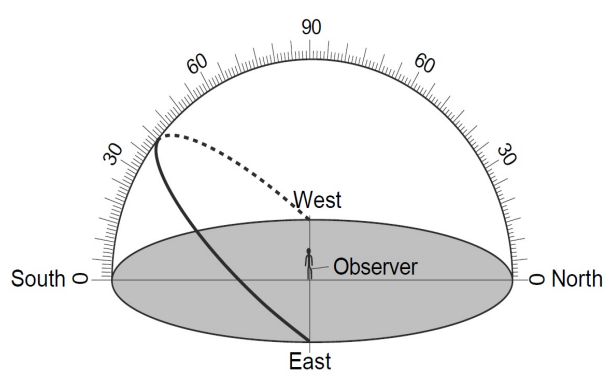
B



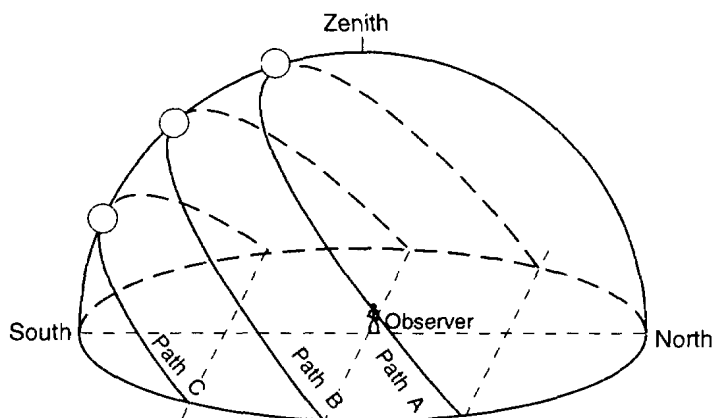
C



D



- 
17. Base your answer to the following question on the diagram below, which shows the apparent paths of the Sun at the beginning of each season for an observer at a location in Connecticut.





What is the time interval from the Sun's apparent path A to the Sun's apparent path C?

- A 1 day                      B 1 month                      C 6 months                      D 12 months

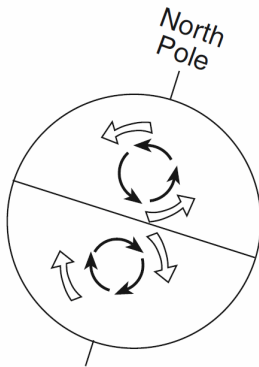
- 
18. The best evidence that Earth spins on its axis is provided by

- A variations in atmospheric density
  - B apparent shifts in the swing of a Foucault pendulum
  - C changes in the position of sunspots on the Sun
  - D eclipses of the Moon
-

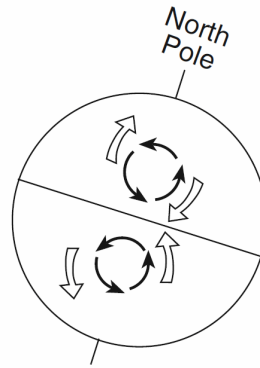
19. Which diagram correctly represents the curving of Earth's ocean currents and prevailing winds due to the Coriolis effect?

Key	
	= Ocean currents
	= Prevailing winds

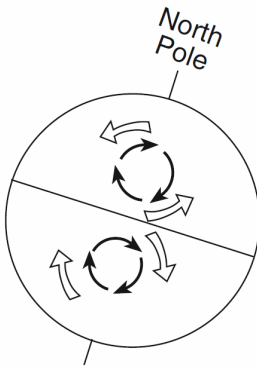
A



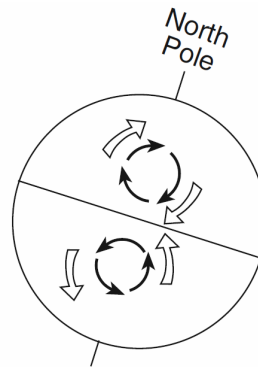
B



C



D



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Base your answers to questions **20** and **21** on the data table below and on your knowledge of Earth Science. The data table shows some constellations that can be seen by an observer in New York State during different seasons.

Season	Constellations
spring	Ursa Minor, Orion, Leo, Scorpius
summer	Ursa Minor, Leo, Scorpius, Aquarius
fall	Ursa Minor, Orion, Scorpius, Aquarius
winter	Ursa Minor, Orion, Leo, Aquarius

20. Which statement best explains why some constellations are *not* seen during all four seasons?

- A Earth revolves around the Sun.
- B Constellations revolve around the Sun.
- C The Moon revolves around Earth.
- D The Sun revolves around the center of the Milky Way.

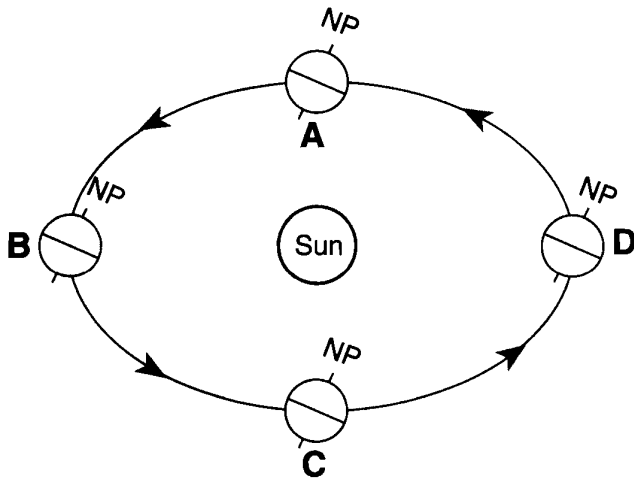
21. The diagram below represents a portion of the constellation Ursa Minor is located almost directly



Ursa Minor can be seen by an observer in New York State during all four seasons because Ursa Minor is located almost directly

- A above Earth's equator
  - B above Earth's North Pole
  - C overhead in New York State
  - D between Earth and the center of the Milky Way
-

Base your answers to questions **22** through **24** on the diagram below, which represents Earth revolving around the Sun. Letters A, B, C, and D represent Earth's location in its orbit on the first day of the four seasons. NP represents the North Pole.

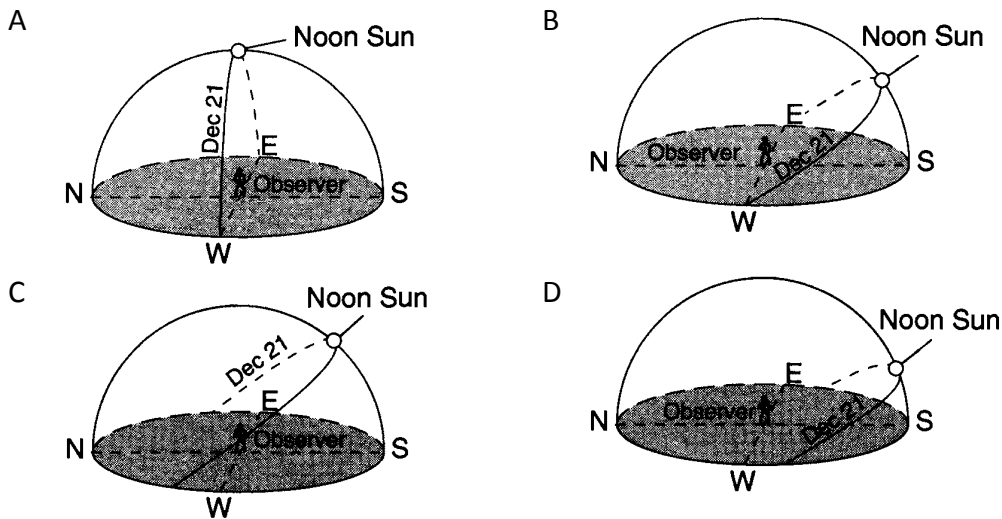


(Not drawn to scale)

22. Which location in Earth's orbit represents the first day of summer in New York State?

- A A                      B B                      C C                      D D

23. Which diagram best represents the Sun's apparent path as seen by an observer at  $43.5^\circ$  N latitude on December 21?

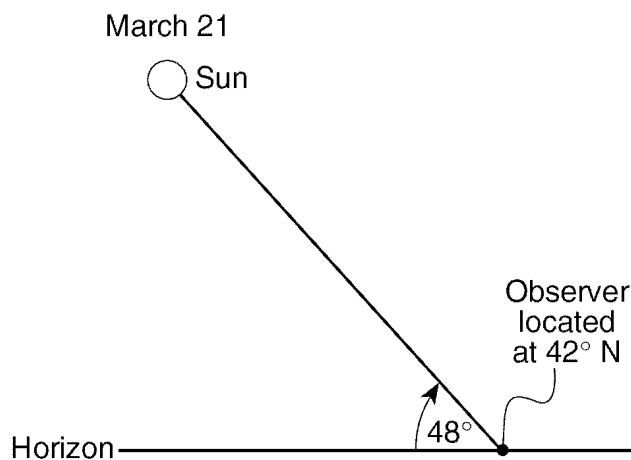


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24. If the tilt of Earth's axis were decreased from  $23.5^\circ$  to  $15^\circ$ , New York State's winters would become

- A warmer, and summers would become cooler
  - B warmer, and summers would become warmer
  - C cooler, and summers would become cooler
  - D cooler, and summers would become warmer
- 

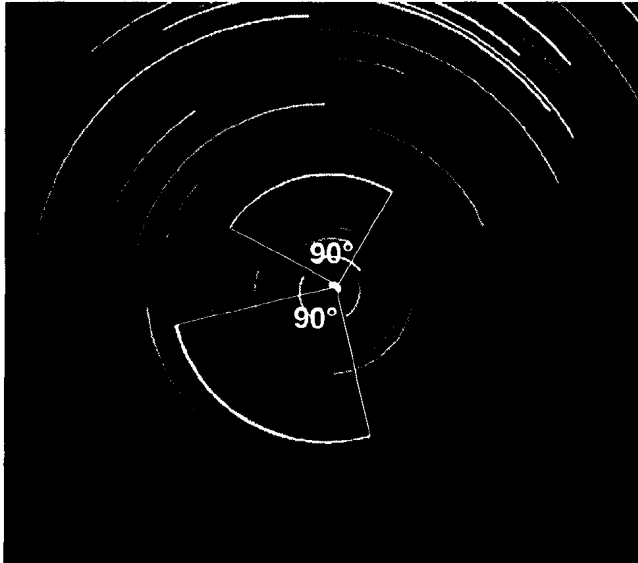
25. The diagram below shows the altitude of the Sun at solar noon on March 21, as seen by an observer at  $42^\circ$  N latitude.



Compared to the altitude of the Sun observed at solar noon on March 21, the altitude of the Sun observed at solar noon on June 21 will be

- |                                |                                  |
|--------------------------------|----------------------------------|
| A $15^\circ$ higher in the sky | B $23.5^\circ$ higher in the sky |
| C $42^\circ$ higher in the sky | D $48^\circ$ higher in the sky   |
-

- 
26. A camera was placed in an open field and pointed toward the northern sky. The lens of the camera was left open for a certain amount of time. The result is shown in the photograph below. The angle of the arc through which two of the stars appeared to move during this time exposure is shown.



How many hours was the lens left open to produce the photograph?

- A 12                      B 2                      C 6                      D 4

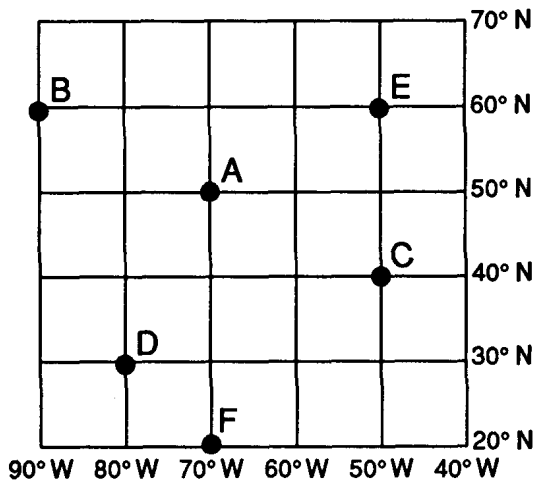
- 
27. Summer days in Texas are likely to be hotter than winter days because in summer

- A Earth is closer to the Sun  
B the number of sunspots increases  
C Earth's northern axis is tilted toward the Sun  
D the Sun gives off more energy

- 
28. The time required for one Earth rotation is about

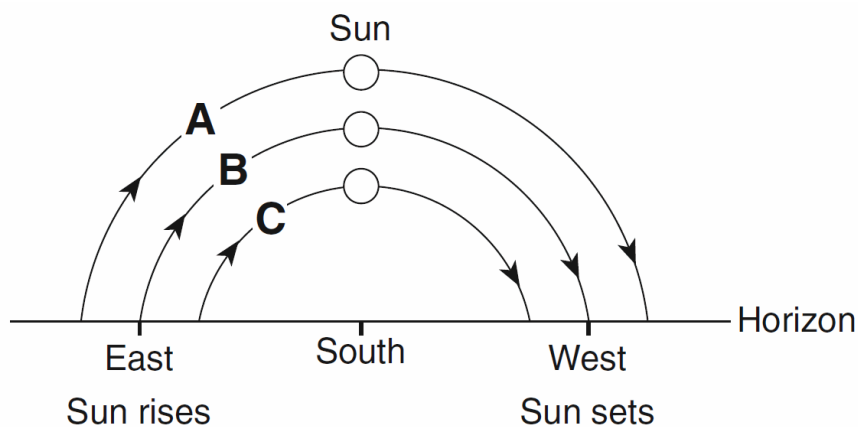
- A one hour              B one day              C one month              D one year
-

Base your answers to questions **29** and **30** on the latitude and longitude system shown below. The map represents a part of the Earth's surface and its latitude-longitude coordinates. Points *A* through *F* represent locations in this area.



- \_\_\_\_\_ 29. Points *B* and *E* would *not* have the same value for measurements of
- |                         |                                     |
|-------------------------|-------------------------------------|
| A latitude              | B time                              |
| C duration of solar day | D altitude of the Sun at solar noon |
- \_\_\_\_\_ 30. As a person travels from location *B* to location *E* the observed altitude of *Polaris* will
- |                   |            |
|-------------------|------------|
| A decrease        | B increase |
| C remain the same |            |

31. 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?

A

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

B

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

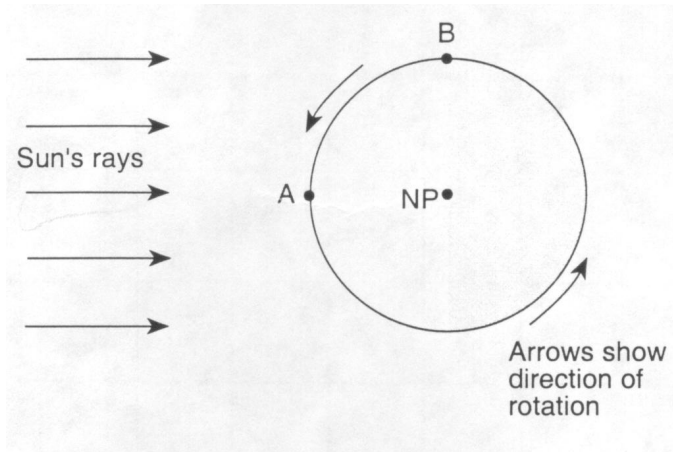
C

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

D

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

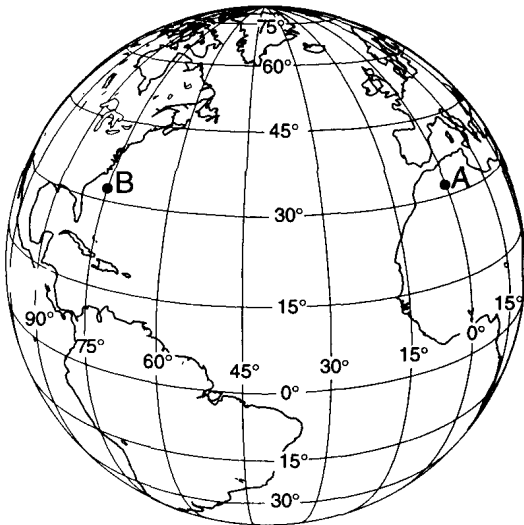
32. The diagram below shows Earth as viewed from above the North Pole (NP). Points *A* and *B* are locations on Earth's surface.



At location *A*, the time is 12 noon. What is the time at location *B*?

- A 6 a.m.      B 6 p.m.      C 3 p.m.      D 12 midnight

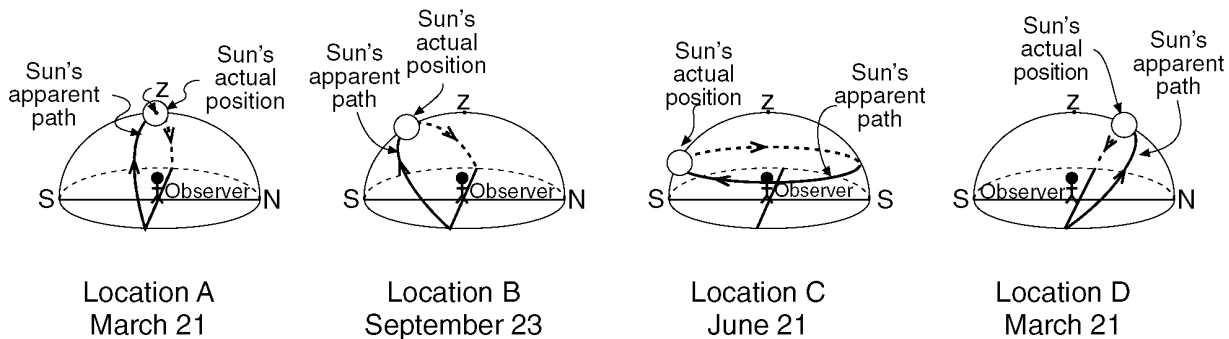
33. The diagram below shows the latitude-longitude grid on an Earth model. Points *A* and *B* are locations on the surface.



On Earth, the solar time difference between point *A* and point *B* would be

- A 1 hour      B 5 hours      C 12 hours      D 24 hours

Base your answers to questions **34** through **36** on the diagram below, which shows a model of the apparent path and position of the Sun in relation to an observer at four different locations, *A*, *B*, *C*, and *D*, on Earth's surface on the dates indicated. The zenith (*z*) and the actual position of the Sun in the model at the time of the observation are shown. [The zenith is the point directly over the observer.]



34. From sunrise to sunset at location *B*, the length of the observer's shadow will

- A increase, only
- B decrease, only
- C increase, then decrease
- D decrease, then increase

35. According to the Sun's actual position shown in the diagrams, the most intense insolation is being received by the observer at location

- A *A*
- B *B*
- C *C*
- D *D*

36. Where on Earth's surface is the observer at location *C* located?

- A at the Equator
- B at the South Pole
- C at the North Pole
- D in Oswego, New York

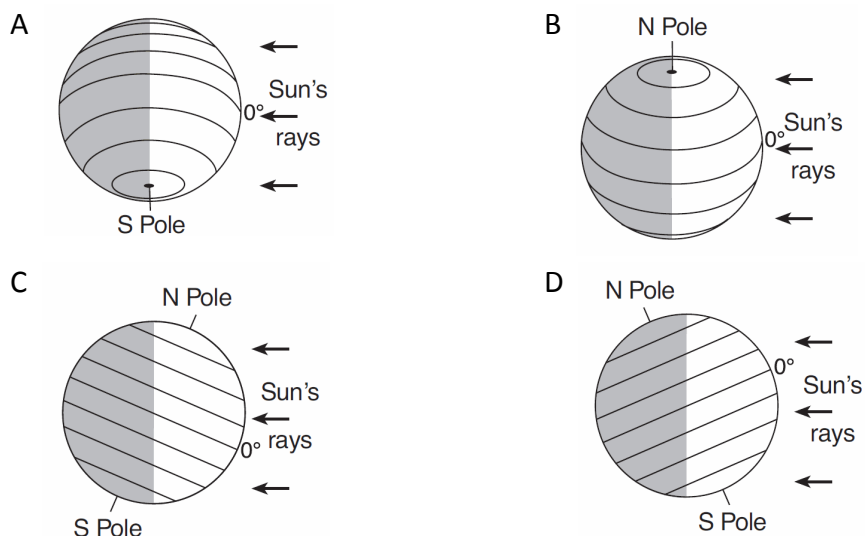
37. The curving of the planetary winds to the right in the Northern Hemisphere is evidence of

- A the Coriolis effect
- B high- and low-pressure belts
- C Earth's revolution
- D the tilt of Earth's axis

38. The length of an Earth year is based on Earth's

- A rotation of 15°/hr
- B revolution of 15°/hr
- C rotation of approximately 1°/day
- D revolution of approximately 1°/day

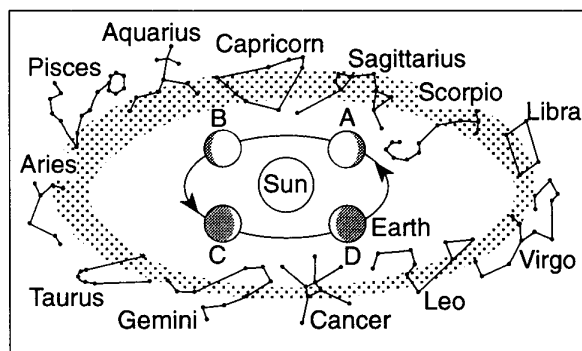
39. Which diagram represents the tilt of Earth's axis relative to the Sun's rays on December 15?



40. Approximately how many degrees does the Earth rotate on its axis in 1 hour?

- A  $1^\circ$       B  $15^\circ$       C  $24^\circ$       D  $360^\circ$

Base your answers to questions **41** and **42** on the diagram below which shows twelve constellations that are visible in the night sky to an observer in New York, over the course of a year. Different positions of Earth are represented by letters *A* through *D*. The arrows represent the direction of Earth's motion around the Sun.



( Not drawn to scale )

41. Which constellations are both visible at midnight to an observer in New York when Earth is located at position *D*?

- A Aries and Taurus      B Pisces and Libra  
C Leo and Virgo      D Aquarius and Scorpio

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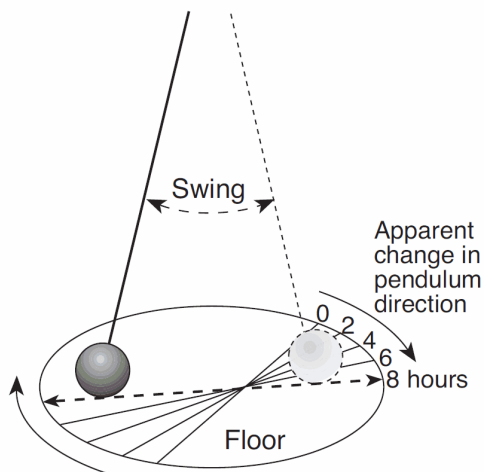
42. The constellations observed from New York when Earth is at position A are different from the constellations observed when Earth is at position C because

- A Earth moves in its orbit
  - B Earth is tilted on its axis
  - C the lengths of day and night are different
  - D the stars move around Earth as shown by star trails
- 

43. At which latitude is the Sun directly overhead on certain days of the year?

- A  $23.5^{\circ}$  N      B  $42^{\circ}$  N      C  $66.5^{\circ}$  N      D  $90^{\circ}$  N

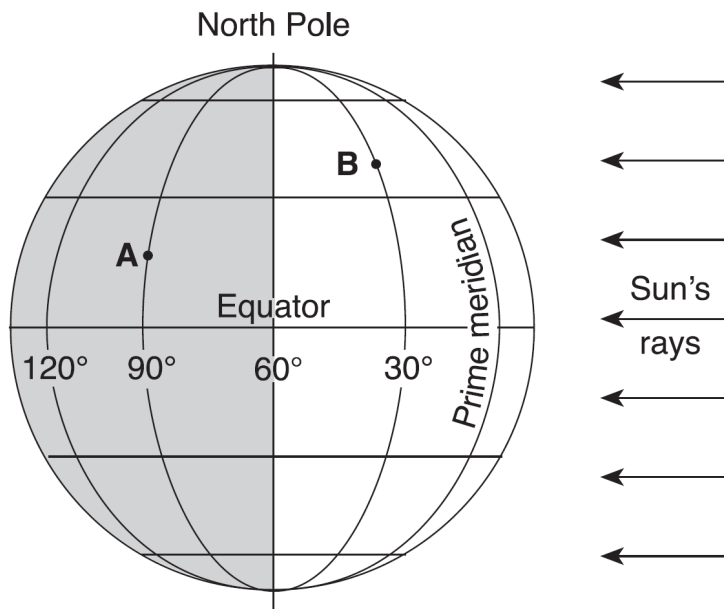
44. The diagram below shows a large pendulum in motion over an 8-hour period.



What is the main reason the pendulum appears to change its direction of swing over time?

- A tilt of Earth on its axis
  - B rotation of Earth on its axis
  - C revolution of Earth in its orbit
  - D speed of Earth in its orbit
-

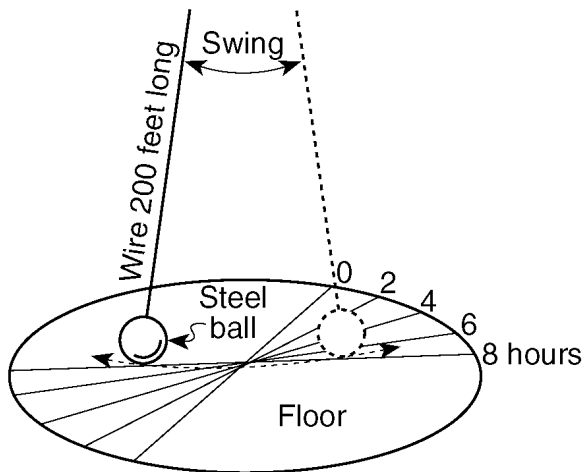
45. The diagram below shows the latitude and longitude lines on Earth. Points *A* and *B* are locations on Earth's surface.



If it is 4 a.m. at location *A*, what time is it at location *B*?

- A 10 a.m.      B 2 a.m.      C 6 a.m.      D 8 a.m.

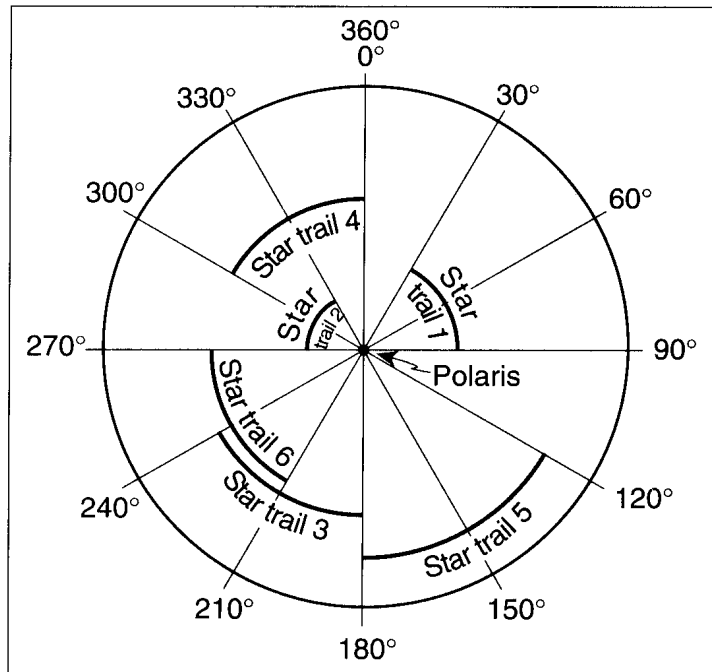
46. The diagram below represents a Foucault pendulum swinging freely for 8 hours.



The Foucault pendulum appears to gradually change its direction of swing due to Earth's

- A orbit around the Sun      B curved surface  
C tilted axis      D spin on its axis

47. A camera was placed outside at night and pointed directly at *Polaris* and several other stars. The lens was kept open and a time-exposure photograph was taken. The diagram below represents that photograph of *Polaris* and star trails, with an angular protractor to measure apparent motion.

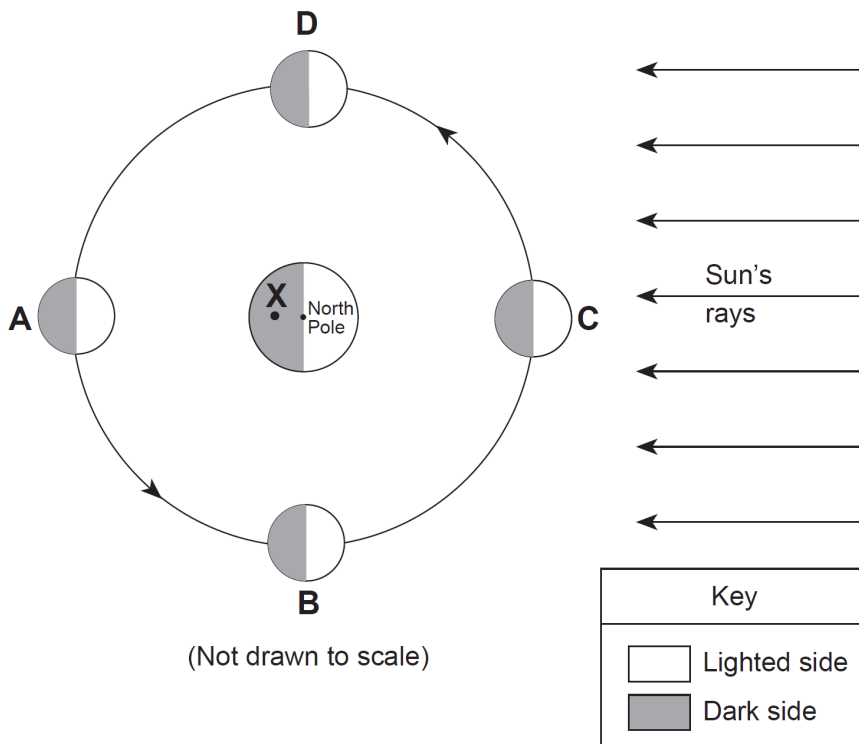


How many hours was the lens kept open to create the star trails in this photograph?

- A 1 hour      B 6 hours      C 3 hours      D 4 hours

Base your answers to questions **48** and **49** on

the diagram below, which shows Earth and the Moon in relation to the Sun. Positions *A*, *B*, *C*, and *D* show the Moon at specific locations in its orbit. Point *X* is a location on Earth's surface.



\_\_\_\_\_ 48. On what date does the line separating day and night pass through Earth's North Pole, as shown in this diagram?

- A December 21    B January 21    C March 21    D June 21

\_\_\_\_\_ 49. What is the time of day at point *X*?

- A 6 a.m.    B noon    C 6 p.m.    D midnight

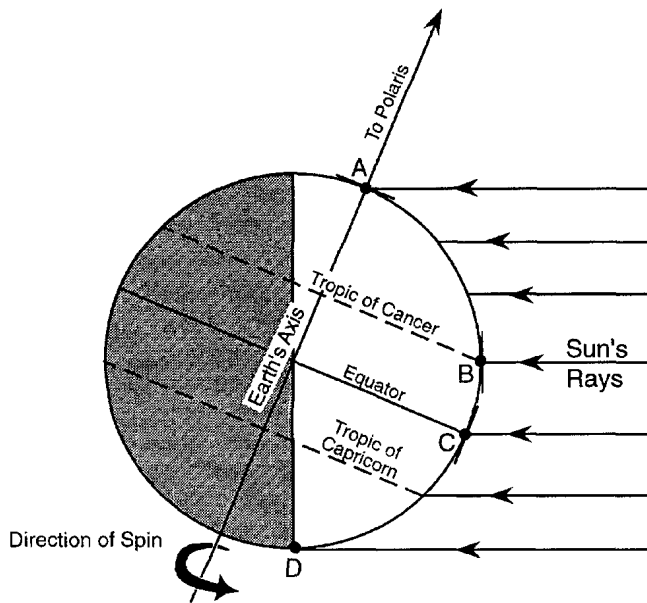
\_\_\_\_\_ 50. The apparent change in direction of a swinging Foucault pendulum is the result of the

- A rotation of Earth    B revolution of Earth  
C tilt of Earth's axis    D shape of Earth's orbit

51. What causes the Coriolis effect?

- A Earth's tilt on its axis
- B the spin of Earth on its axis
- C the orbital motion of the Moon around Earth
- D the orbital motion of Earth around the Sun

Base your answers to questions **52** through **56** on the diagram below. The diagram represents the Earth at a position in orbit around the Sun, the Sun's rays at solar noon, and the direction to *Polaris*. Letters A through D represent positions on the Earth's surface.



52. A projectile is launched from a point near the North Pole toward the Equator. Which diagram best represents the apparent path of the projectile, as viewed from the Earth?

- A
- B
- C
- D

53. Which date is represented by the diagram?

- A March 21
- B June 21
- C September 23
- D December 21

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54. Which position is receiving the Sun's rays from directly overhead at solar noon?

A A

B B

C C

D D

55. What is the latitude of position A?

A  $23\frac{1}{2}^{\circ}$  N

B  $47^{\circ}$  N

C  $66\frac{1}{2}^{\circ}$  N

D  $90^{\circ}$  N

56. During one complete rotation of the Earth on its axis, which position receives the *least* number of hours of daylight?

A A

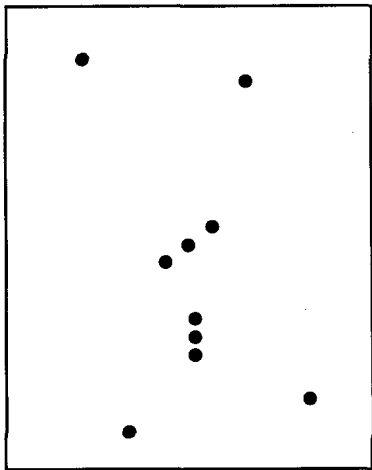
B B

C C

D D

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57. The diagram below represents the major stars of the constellation Orion, as viewed by an observer in New Jersey.



Which statement best explains why Orion can be observed from New York State on December 21 but not on June 21?

A Orion has an eccentric orbit around Earth.

B Orion has an eccentric orbit around the Sun.

C Earth revolves around the Sun.

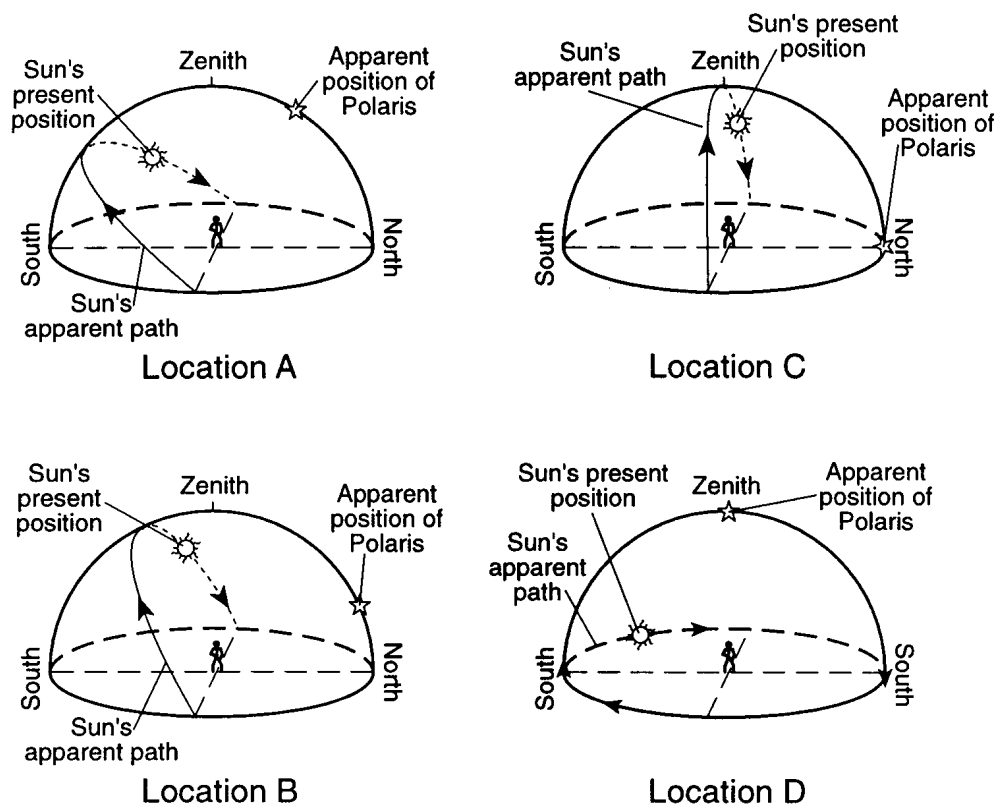
D Earth rotates on its axis.

---

58. The length of an Earth day is determined by the time required for approximately one

- A Earth rotation
- B Earth revolution
- C Sun rotation
- D Sun revolution

Base your answers to questions 59 and 60 on the diagram below, which represents the apparent path of the Sun observed at four locations on Earth's surface on March 21. The present positions of the Sun, *Polaris*, and the zenith (position directly overhead) are shown for an observer at each location.

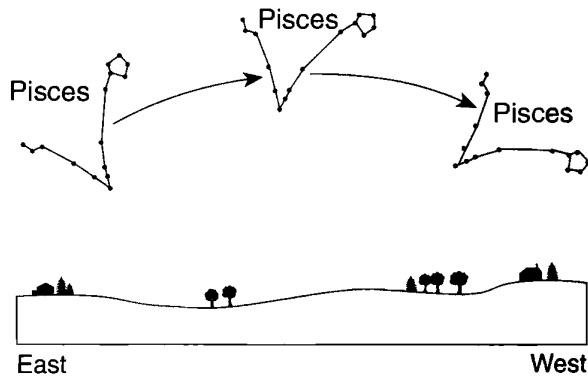


59. Explain why the intensity of sunlight at noon on March 21 is greater at location C than at the other locations.

60. State the approximate time of day for the observer at location B when the Sun is at the position shown in the diagram.

---

61. The constellation Pisces changes position during a night, as shown in the diagram below.



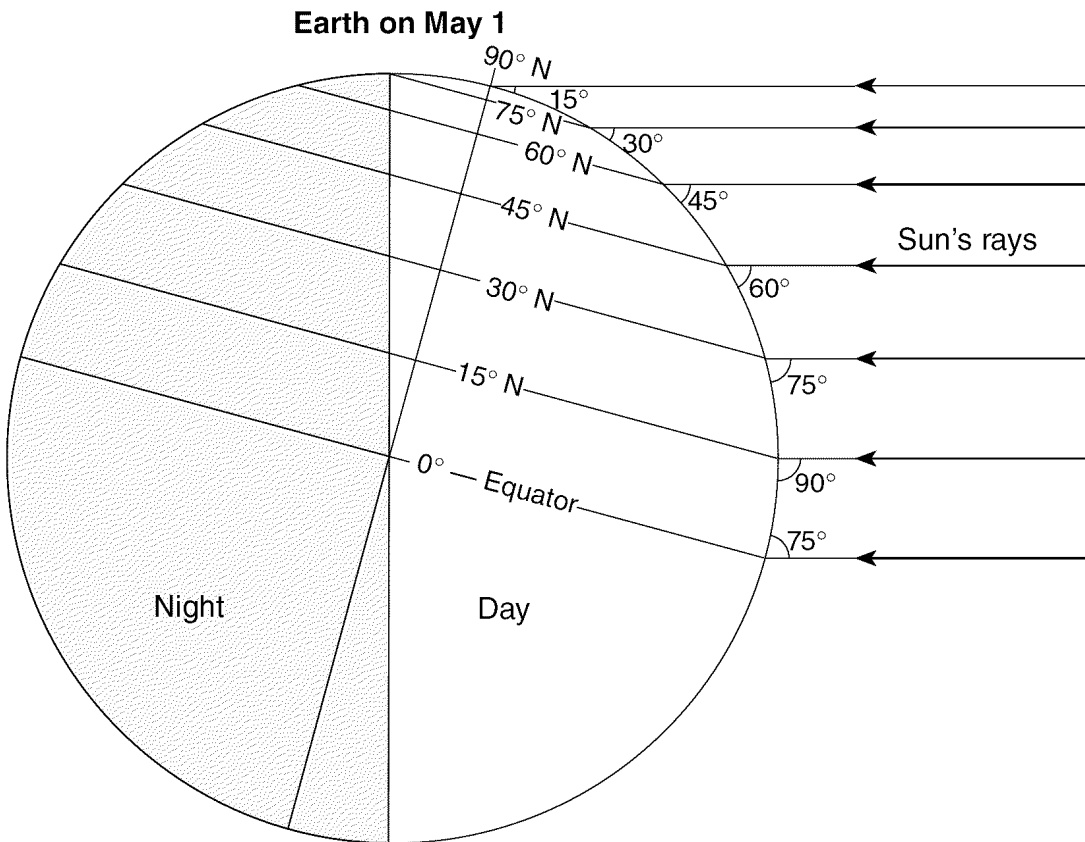
Which motion is mainly responsible for this change in position?

- A revolution of Earth around the Sun    B rotation of Earth on its axis  
C revolution of Pisces around the Sun    D rotation of Pisces on its axis

62. The best evidence that Earth spins on its axis is the motion of

- A tectonic plates    B *Polaris*  
C a wind vane    D a Foucault pendulum
-

Base your answers to questions **63** and **64** on the diagram below, which shows the angle of the Sun's noontime rays received at different Earth latitudes on May 1.



63. Which changes can be expected to occur at 45° N over the next 30 days?

- A The duration of insolation will decrease and the temperature will decrease.
- B The duration of insolation will decrease and the temperature will increase.
- C The duration of insolation will increase and the temperature will decrease.
- D The duration of insolation will increase and the temperature will increase.

64. At which latitude can the noontime Sun be observed in the northern part of the sky?

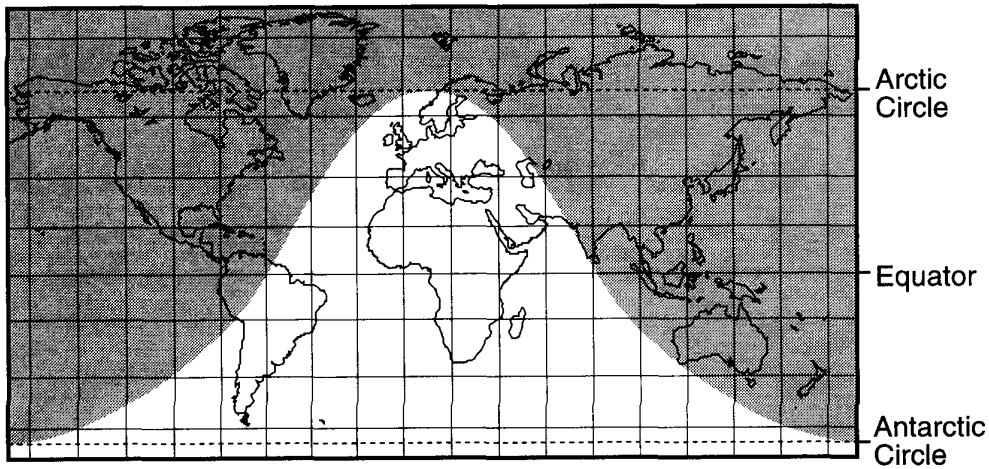
- A 0°
- B 30° N
- C 60° N
- D 90° N

65. Approximately how many degrees per day does Earth revolve in its orbit around the Sun?

- A 1°
- B 13°
- C 15°
- D 23.5°

---

66. The shaded portion of the map below indicates areas of night and the unshaded portion indicates areas of daylight.



What day of the year is best represented by the map?

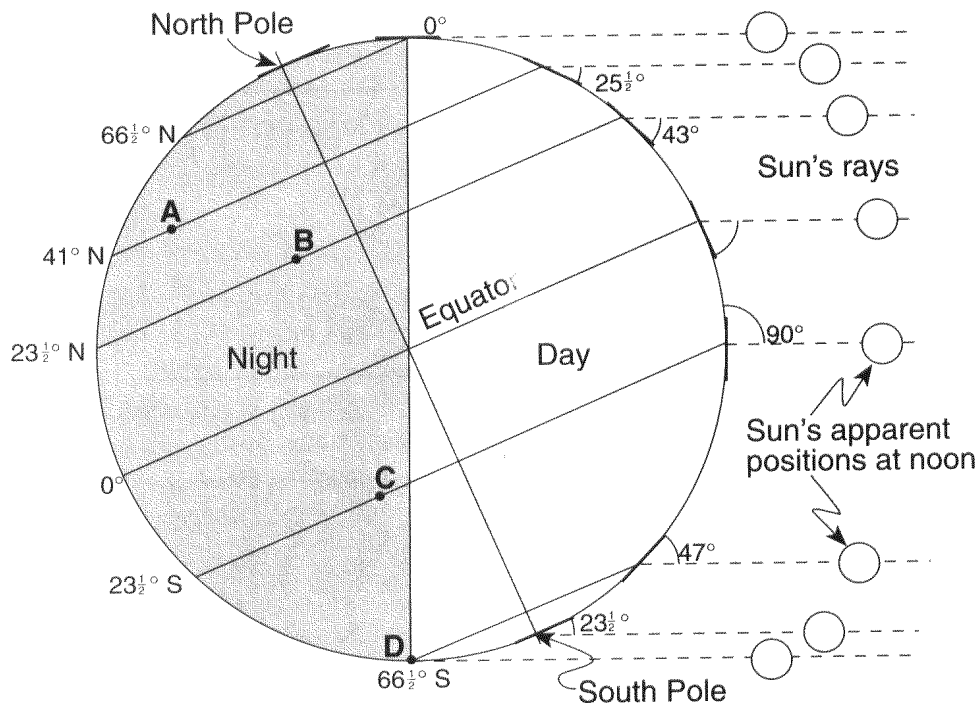
- A March 21      B June 21      C September 21      D December 21

---

67. During which season in the Northern Hemisphere is the Earth closest to the Sun?

- A spring      B summer      C fall      D winter
-

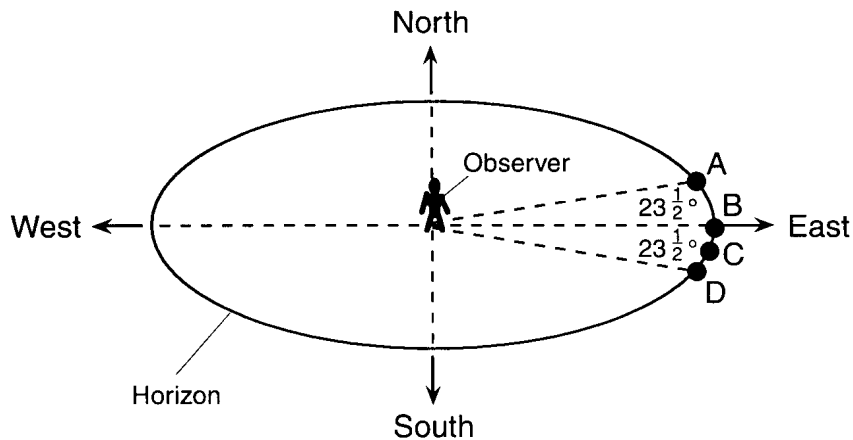
Base your answers to questions **68** through **70** on the diagram below, which shows the altitude and apparent position of the noontime Sun, as seen from various latitudes on Earth on a particular day of the year. Letters *A* through *D* represent locations on Earth's surface.



(Not drawn to scale)

68. Which lettered location will experience the *shortest* period of daylight during one Earth rotation on this day?
- A A                      B B                      C C                      D D
69. Which season will begin at 41° N latitude, three months after the date represented by this diagram?
- A summer              B fall                      C winter                      D spring
70. What is the altitude of the noontime Sun at the Equator on this date?
- A  $23\frac{1}{2}$                       B 43                      C  $66\frac{1}{2}$                       D 90

71. The diagram below, which represents a horizon in Pennsylvania, shows four positions of sunrise, A, B, C, and D, on different days of the year.



At which position would sunrise occur on June 21?

- A A                      B B                      C C                      D D

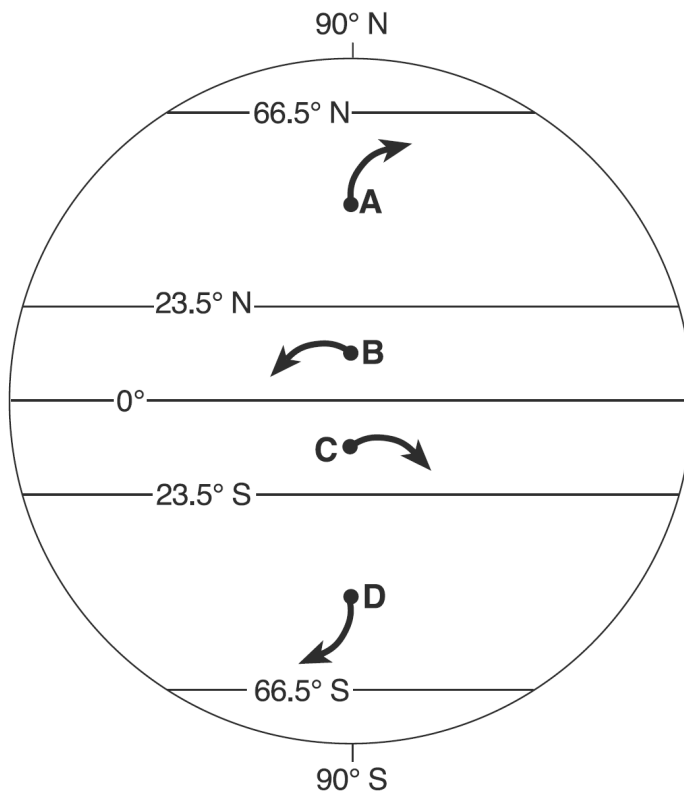
72. Which sequence of stars is listed in order of increasing luminosity?

- A *Spica, Rigel, Deneb, Betelgeuse*  
B *Polaris, Deneb, 40 Eridani B, Proxima Centauri*  
C *Barnard's Star, Alpha Centauri, Rigel, Spica*  
D *Procyon B, Sun, Sirius, Betelgeus*

73. A Foucault pendulum appears to change its direction of swing because Earth

- A is tilted on its axis                      B is spinning on its axis  
C has a curved surface                      D has a density of  $5.5 \text{ g/cm}^3$

- 
74. The arrows in the diagram below show changes in the direction of surface winds at four lettered locations, *A*, *B*, *C*, and *D*, on Earth.



The arrow at which location correctly shows a deflection of the wind that could be due to the Coriolis effect?

A *A*

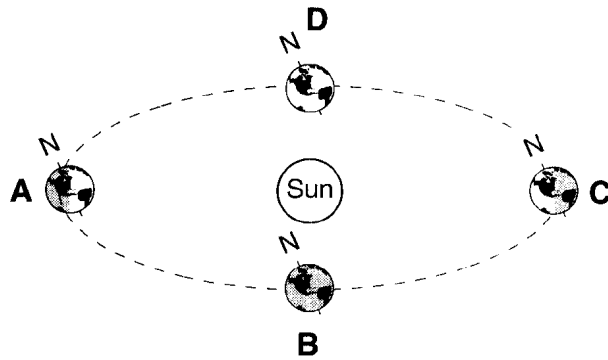
B *B*

C *C*

D *D*

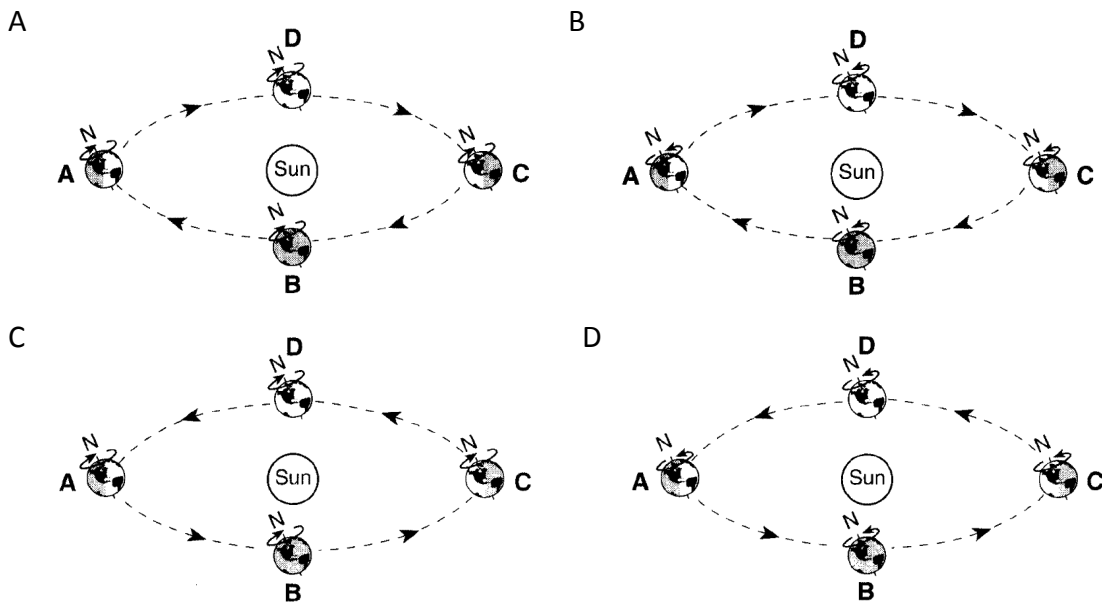
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Base your answers to questions **75** through **77** on the diagram below, which represents Earth in its orbit around the Sun. The position of Earth on the first day of each season is labeled A, B, C, and D.



(Not drawn to scale)

75. Which diagram correctly shows the directions of Earth's revolution and rotation?



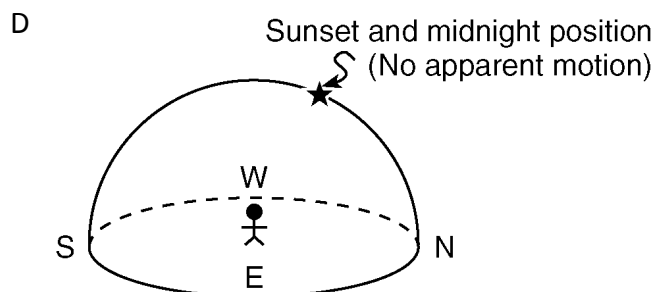
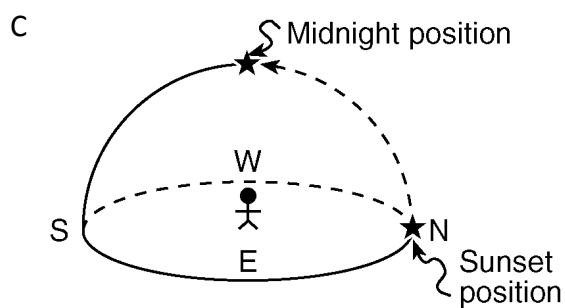
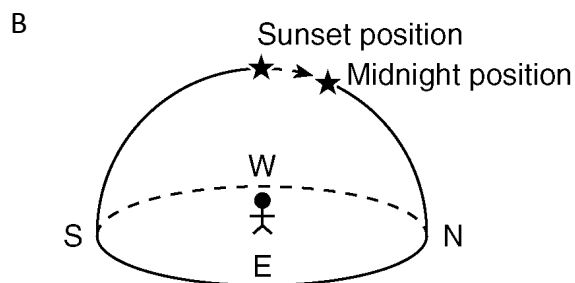
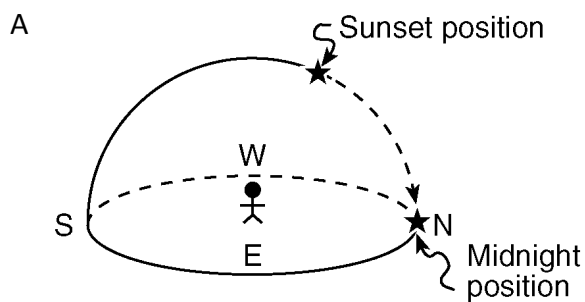
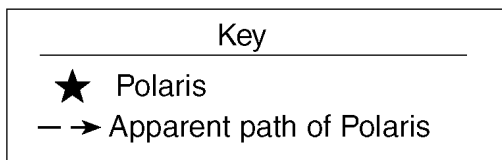
76. Which event is caused by Earth's revolution?

- A the apparent shift in the path of a Foucault pendulum
- B deflection of planetary winds to the right in the Northern Hemisphere
- C the apparent rising and setting of the Sun
- D different constellations observed in the night sky throughout the year

77. What is the approximate rate of Earth's revolution around the Sun?

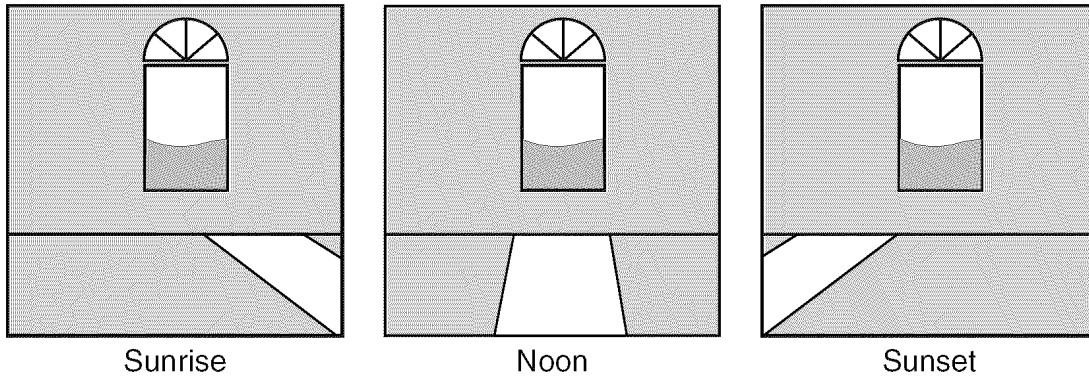
- A  $1^\circ$  per day
- B  $1^\circ$  per year
- C  $15^\circ$  per day
- D  $15^\circ$  per year

78. Which diagram correctly shows the apparent motion of *Polaris* from sunset to midnight for an observer in northern Canada?



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Base your answers to questions **79** and **80** on the diagram below, which shows sunlight entering a room through the same window at three different times on the same winter day.

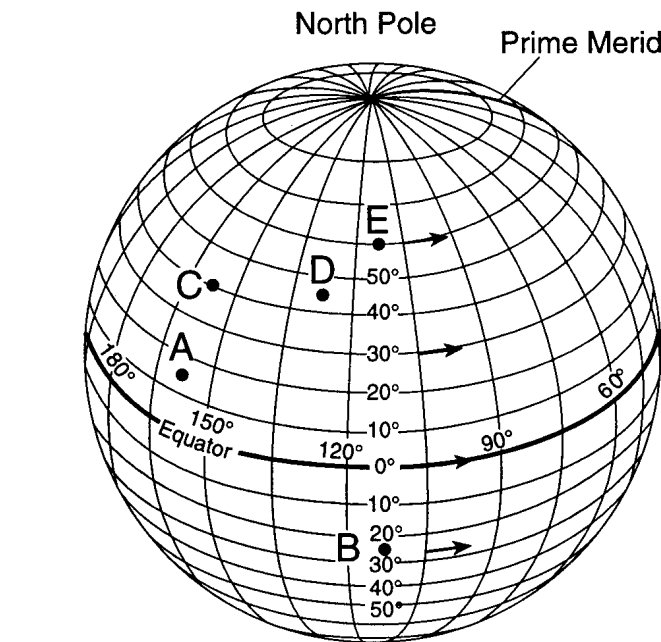


79. The apparent change in the Sun's position shown in the diagram is best explained by

- A the Sun rotating at a rate of  $15^\circ$  per hour
- B Earth rotating at a rate of  $15^\circ$  per hour
- C the Sun's axis tilted at an angle of  $23\frac{1}{2}^\circ$
- D Earth's axis tilted at an angle of  $23\frac{1}{2}^\circ$

80. This room is located in a building in Connecticut. On which side of the building is the window located?

- A north
  - B south
  - C east
  - D west
-

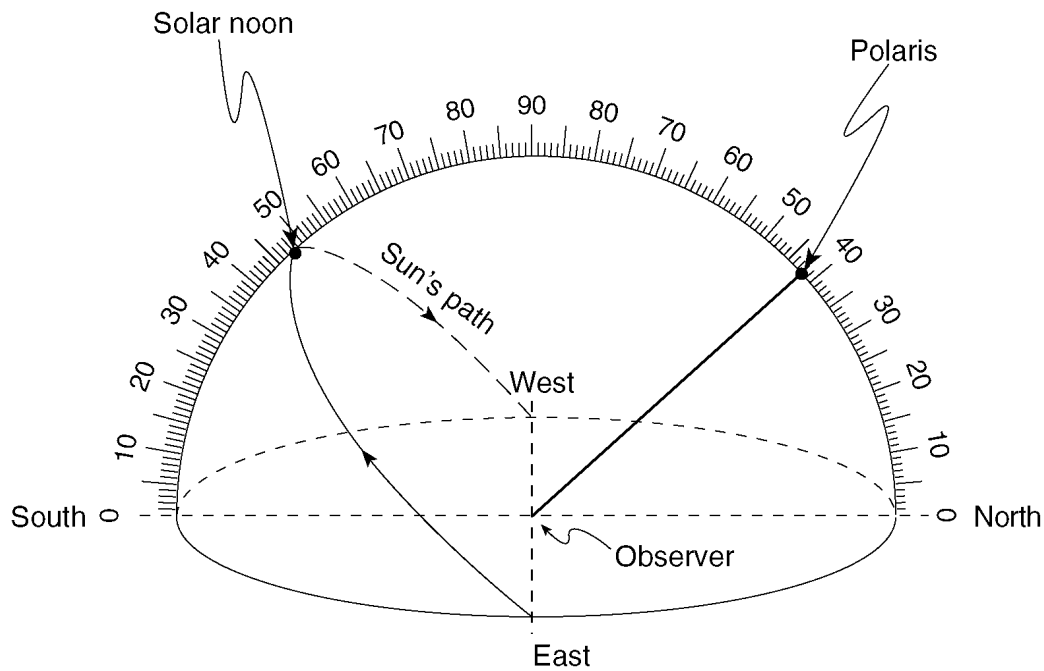


- $A \ A \qquad B \ E \qquad C \ C \qquad D \ D$

- A A                      B B                      C C                      D E

- A 1 p.m.      B 5 p.m.      C 3 p.m.      D 3 a.m.

Base your answers to questions **84** through **86** on the diagram below, which represents a model of the sky (celestial sphere) for an observer in New York State. The curved arrow represents the Sun's apparent path for part of one day. The altitude of *Polaris* is also indicated.



84. Where is this observer most likely located?

- A Massena                      B Oswego  
C Slide Mountain              D Mt. Marcy

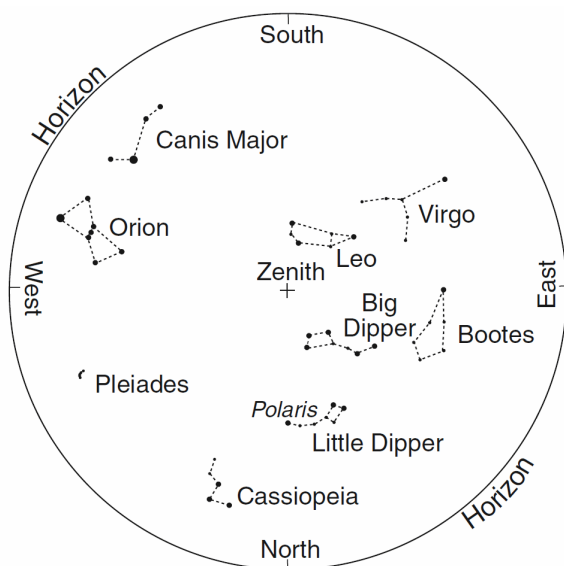
85. On which date could this observation of the Sun's apparent path have been made?

- A March 21              B July 21              C October 21              D December 21

86. According to this diagram, what is the Sun's altitude at solar noon?

- A 23.5°              B 42°              C 48°              D 90°

Base your answers to questions **87** and **88** on the map of the night sky below, which represents the apparent locations of some of the constellations that are visible to an observer at approximately  $40^{\circ}$  N latitude at 9 p.m. in April. The point directly above the observer is labeled zenith.

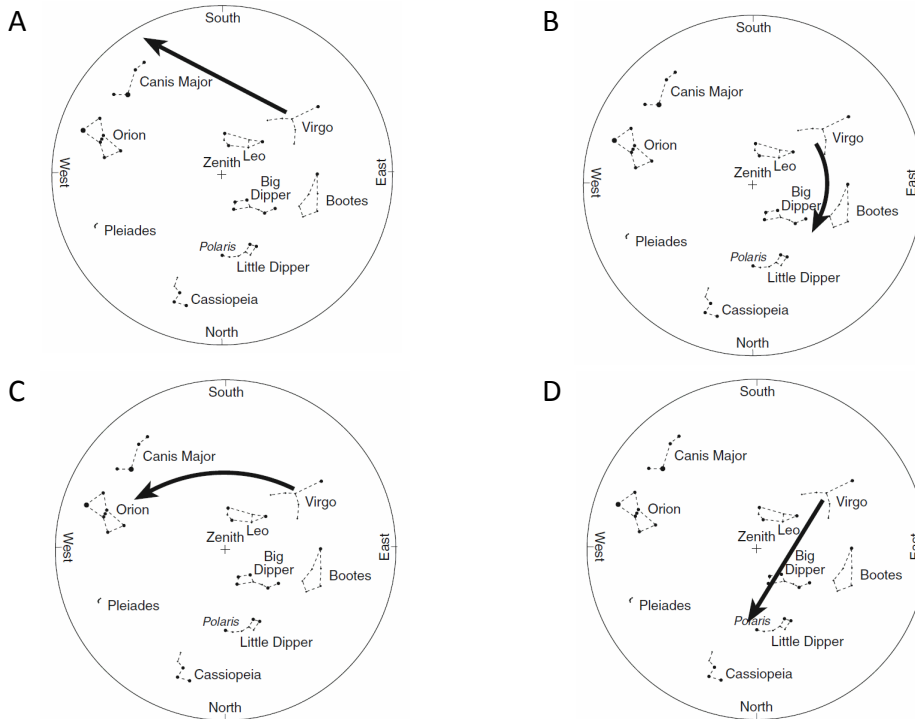


87. Which motion causes the constellation Leo to no longer be visible to an observer at  $40^{\circ}$  N in October?

- A spin of the constellation on its axis
- B revolution of the constellation around the Sun
- C spin of Earth on its axis
- D revolution of Earth around the Sun

---

88. Which map best illustrates the apparent path of Virgo during the next 4 hours?



---

89. On which day of the year does Connecticut have the *fewest* hours of daylight?

- A April 21      B June 21      C October 21      D December 21

---

90. The planetary winds in Earth's Northern Hemisphere generally curve to the right due to Earth's

- A orbit around the Sun      B spin on its axis  
C magnetic field      D force of gravity

---

91. Why do stars appear to move through the night sky at the rate of 15 degrees per hour?

- A The Earth actually moves around the Sun at a rate of 15° per hour.  
B The stars actually move around the center of the galaxy at a rate of 15° per hour.  
C The Earth actually rotates at a rate of 15° per hour.  
D The stars actually revolve around the Earth at a rate of 15° per hour.
-

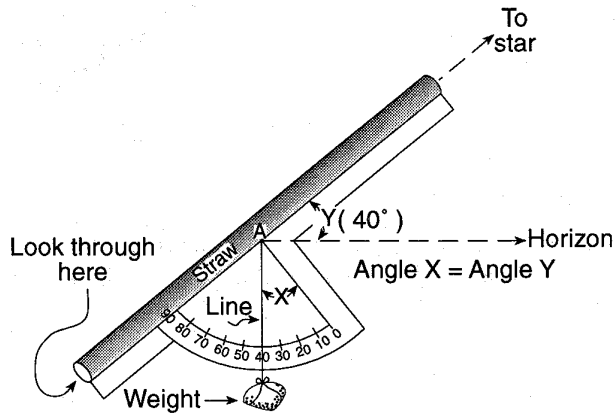
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92. Surface ocean currents curve to the right in the Northern Hemisphere because

- A the Moon spins on its axis
- B the Moon travels in an orbit around Earth
- C Earth spins on its axis
- D Earth travels in an orbit around the Sun

---

93. The diagram below shows an instrument made from a drinking straw, protractor, string, and rock.



This instrument was most likely used to measure the

- |                      |                                |
|----------------------|--------------------------------|
| A distance to a star | B altitude of a star           |
| C mass of the Earth  | D mass of the suspended weight |

---

94. The *lowest* surface air temperatures in the Southern Hemisphere usually occur during the month of

- |           |         |        |           |
|-----------|---------|--------|-----------|
| A January | B April | C July | D October |
|-----------|---------|--------|-----------|

---

95. Which motion causes the constellation Orion to be visible at midnight from New York State in winter but not in summer?

- |                       |                       |
|-----------------------|-----------------------|
| A rotation of Earth   | B rotation of Orion   |
| C revolution of Earth | D revolution of Orion |
-

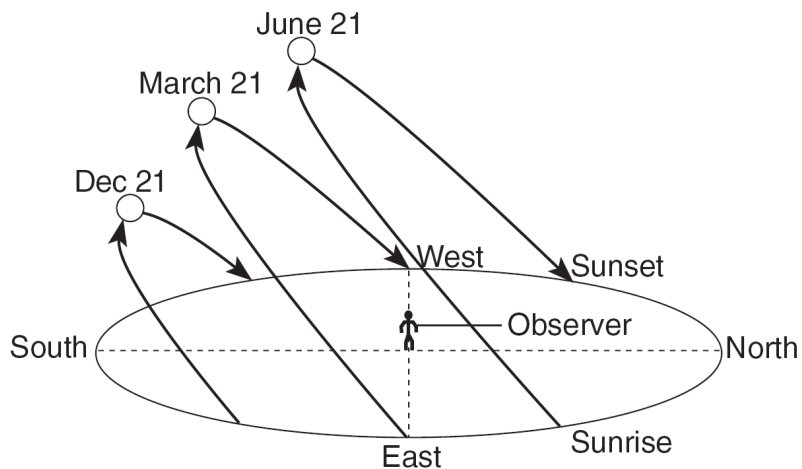
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96. Which event is a direct result of Earth's revolution?

- A the apparent deflection of winds
- B the changing of the Moon phases
- C the seasonal changes in constellations viewed in the night sky
- D the daily rising and setting of the Sun

---

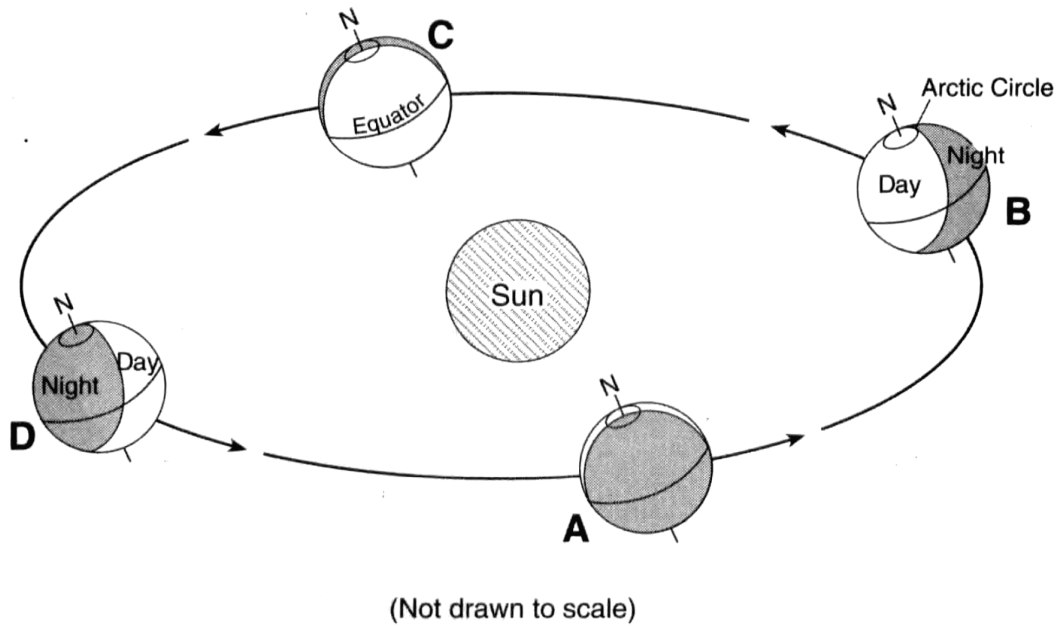
97. The diagram below shows the apparent daily path of the Sun, as viewed by an observer at a certain latitude on three different days of the year.



At which latitude were these apparent Sun paths most likely observed?

- A  $0^\circ$
  - B  $23.5^\circ$  N
  - C  $43^\circ$  N
  - D  $66.5^\circ$  N
-

98. The diagram below shows Earth's orbit around the Sun. Locations *A*, *B*, *C*, and *D* represent Earth on the first day of each season.



Which location represents March 21?

- A A                      B B                      C C                      D D

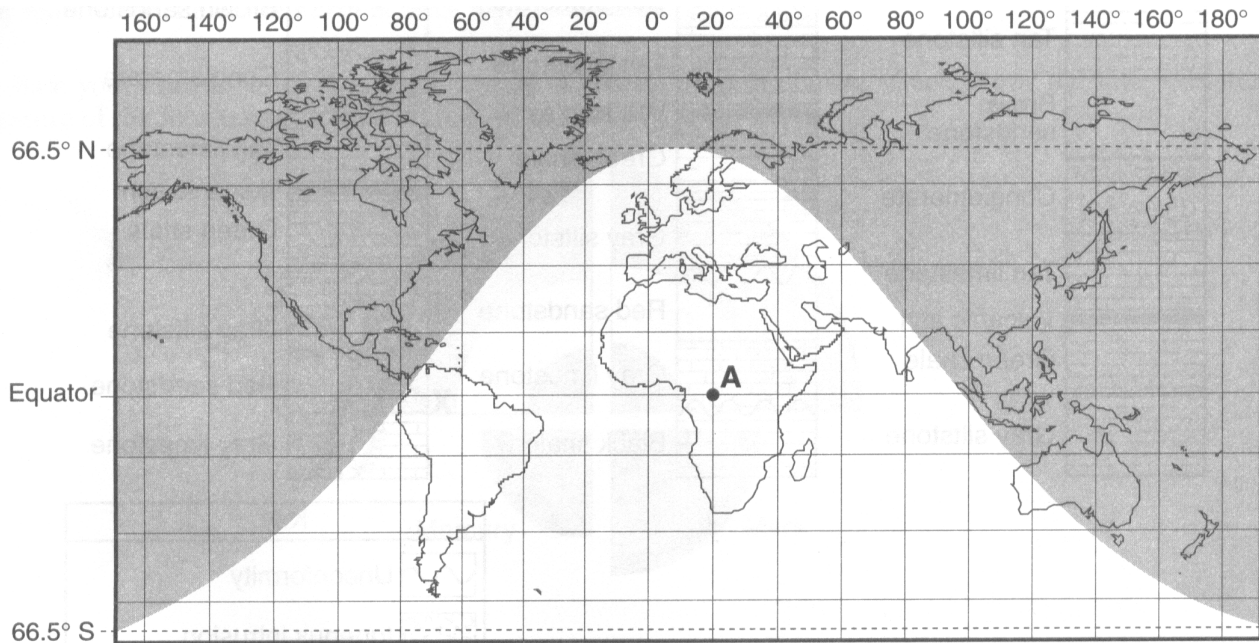
99. Which location on the Earth would the Sun's vertical rays strike on December 21?

- A Tropic of Cancer ( $23\frac{1}{2}^{\circ}$  N)                      B Equator ( $0^{\circ}$ )  
C Tropic of Capricorn ( $23\frac{1}{2}^{\circ}$  S)                      D South Pole ( $90^{\circ}$  S)

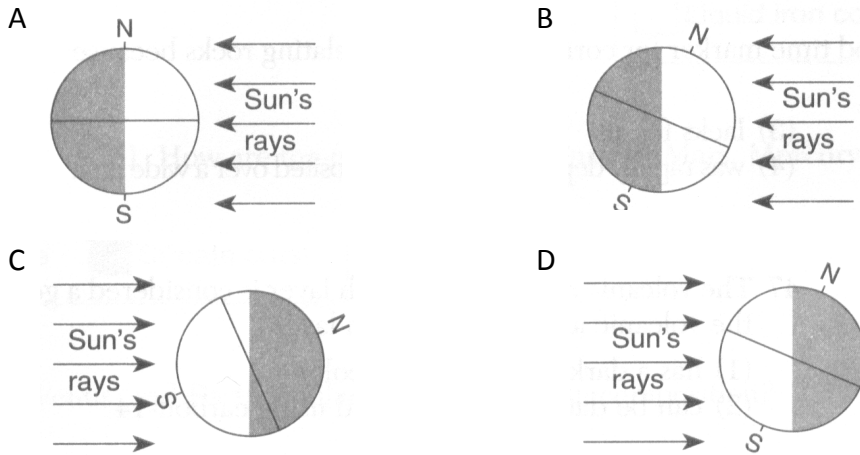
100. To a nighttime observer on Earth, how many degrees do the stars appear to move around *Polaris* in 3 hours?

- A  $60^{\circ}$                       B  $45^{\circ}$                       C  $3^{\circ}$                       D  $15^{\circ}$

Base your answers to questions **101** through **103** on the world map below. The shaded portion of the map indicates areas of night, and the unshaded portion indicates areas of daylight on a certain day of the year. Dashed latitude lines represent the Arctic Circle ( $66.5^{\circ}$  N) and the Antarctic Circle ( $66.5^{\circ}$  S). Point A is a location on Earth's surface.



101. Which diagram shows the position of Earth relative to the Sun's rays on this day?



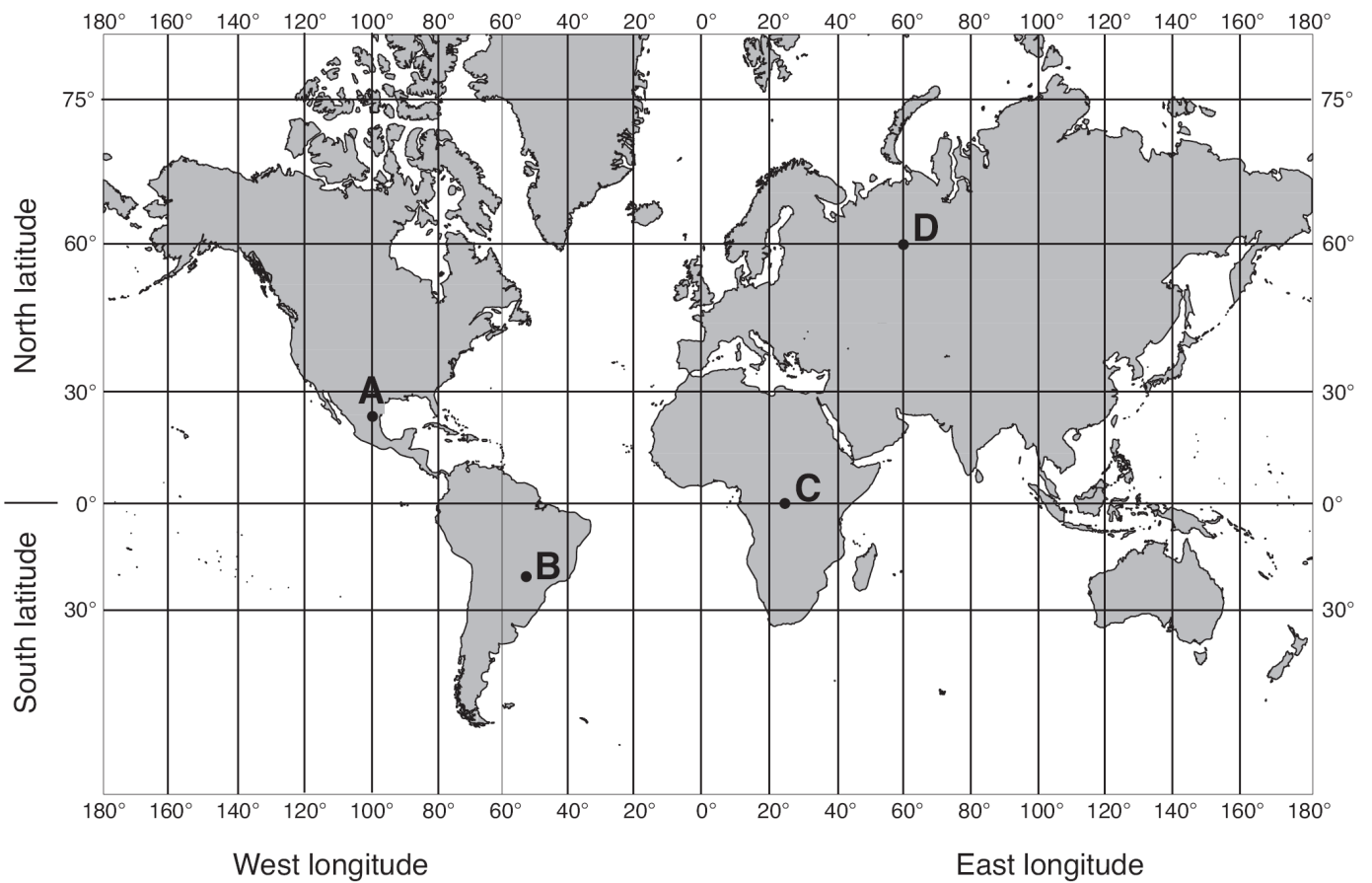
102. On this day, the duration of daylight from the equator to the Arctic Circle

- A decreases, only
- B increases, only
- C decreases, then increases
- D increases, then decreases

103. Approximately how many hours of daylight would occur at position A on this day?

- A 6
- B 9
- C 12
- D 15

Base your answers to questions **104** and **105** on the world map below. Letters *A* through *D* represent locations on Earth's surface.



\_\_\_\_\_ 104. Which location receives 12 hours of daylight and 12 hours of darkness on June 21?

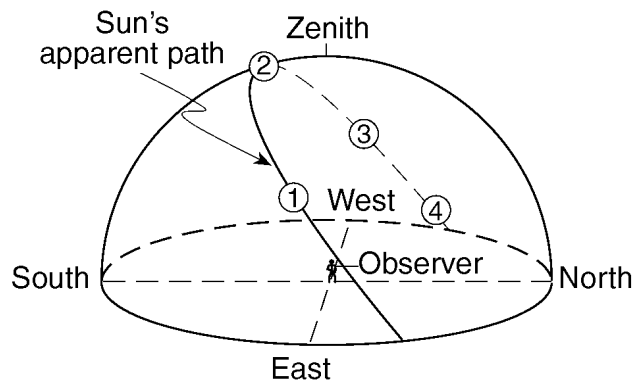
A A                      B B                      C C                      D D

\_\_\_\_\_ 105. At which location on December 21 is the Sun directly overhead at solar noon?

A A                      B B                      C C                      D D

---

Base your answers to questions **106** and **107** on the diagram below, which shows numbered positions of the Sun at four different times along the Sun's apparent daily path, as seen by an observer in New Jersey. Numbers 1 through 4 represent apparent positions of the Sun.



106. The observer had the longest shadow when the Sun was at position

- A 1                      B 2                      C 3                      D 4

107. During which day of the year is the Sun most likely to follow the apparent path shown?

- A March 1              B July 1              C October 1              D December 1
- 

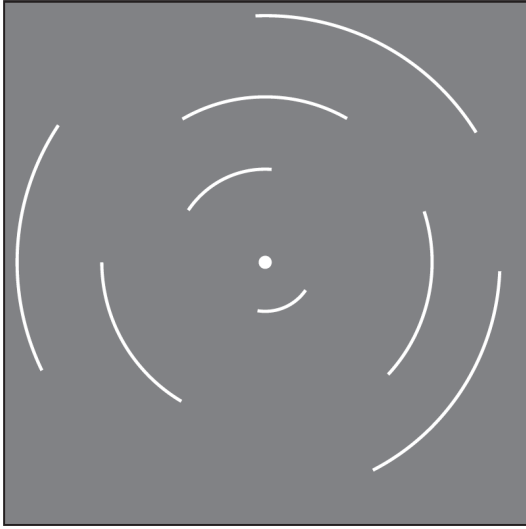
108. In the Northern Hemisphere, planetary winds blowing from north to south are deflected, or curved, toward the west. This deflection is caused by the

- A unequal heating of land and water surfaces  
B movement of low-pressure weather systems  
C orbiting of Earth around the Sun  
D spinning of Earth on its axis

109. Units of time are based on Earth's motion relative to other celestial objects. The year is best defined as Earth's motion relative to the

- A asteroids              B Sun              C Moon              D planets
-

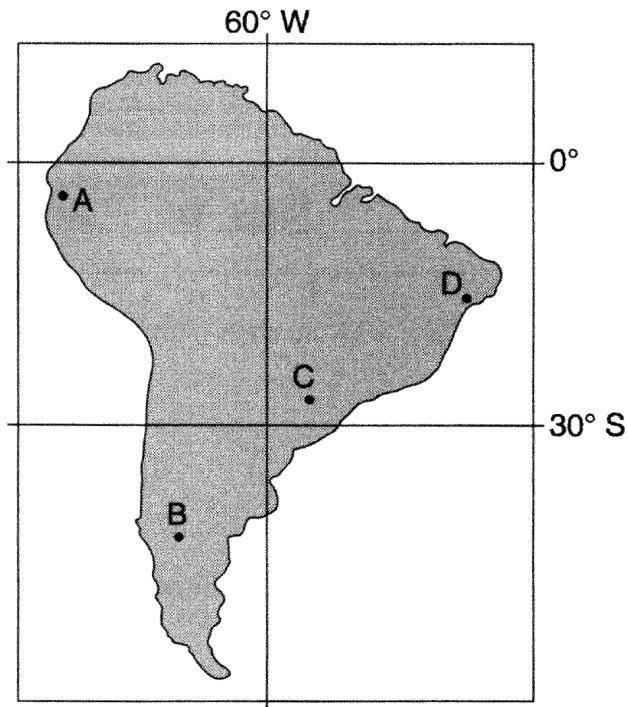
- 
110. At a location in the Northern Hemisphere, a camera was placed outside at night with the lens pointing straight up. The shutter was left open for four hours, resulting in the star trails shown below.



At which latitude were these star trails observed?

- A  $1^\circ$  N      B  $30^\circ$  N      C  $60^\circ$  N      D  $90^\circ$  N
111. If the axis of Earth were *not* tilted relative to the plane of its orbit around the Sun, the result would be
- A a greater number of hours in a day  
B a greater number of days in a year  
C a reversal of polar and equatorial climates  
D an equal number of hours of daylight at most locations
112. During which Northern Hemisphere season is Earth closest to the Sun?
- A spring      B summer      C autumn      D winter
-

113. The map below shows four locations, *A*, *B*, *C*, and *D*, on the continent of South America.



Which location is the first to experience sunset on September 23?

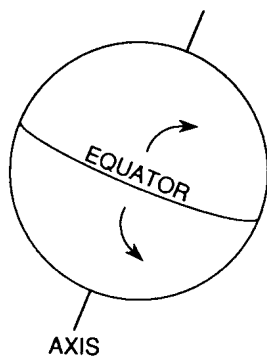
A A

B B

C C

D D

114. In the diagram below, the arrows represent the paths of moving fluids on the surface of the Earth.



Which statement best explains why the fluid is deflected?

A The Earth is rotating on its axis.

B The axis of the Earth is tilted.

C The Earth is revolving around the Sun.

D The Earth is moving away from the Sun.

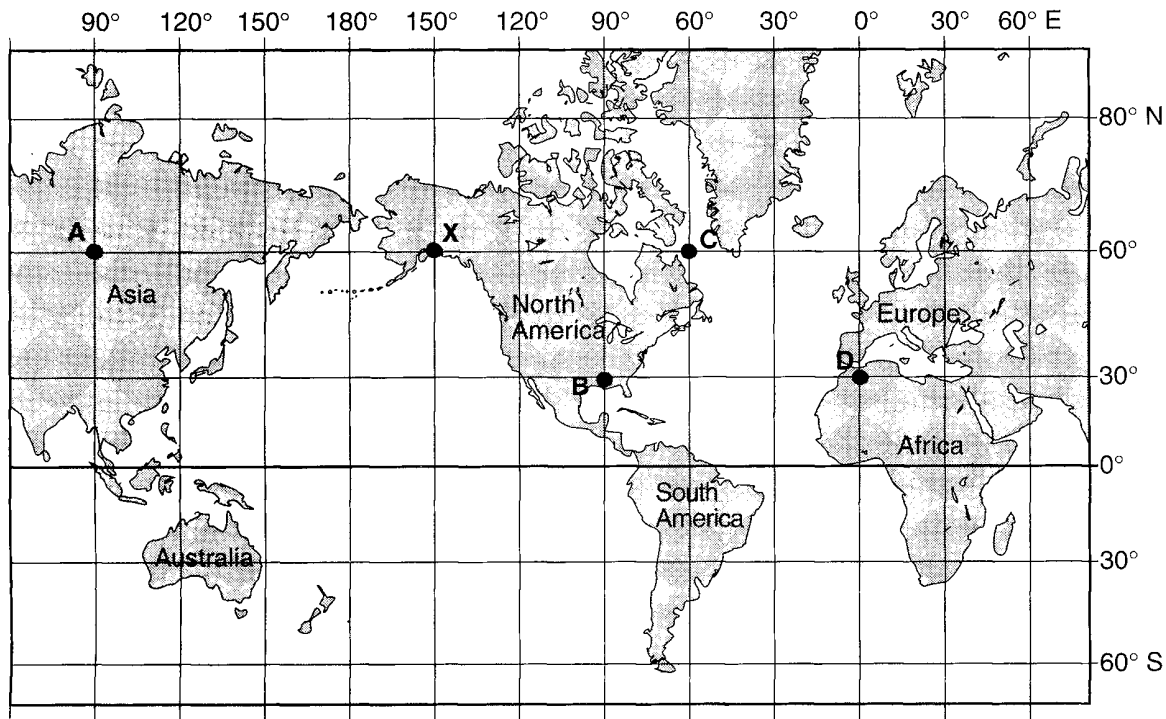
115. The Coriolis effect provides evidence that Earth

- A rotates on its axis
- B revolves around the Sun
- C undergoes cyclic tidal changes
- D has a slightly eccentric orbit

116. To an observer located at the Equator, on which date would the Sun appear to be directly overhead at noon?

- A February 1
- B June 6
- C March 21
- D December 21

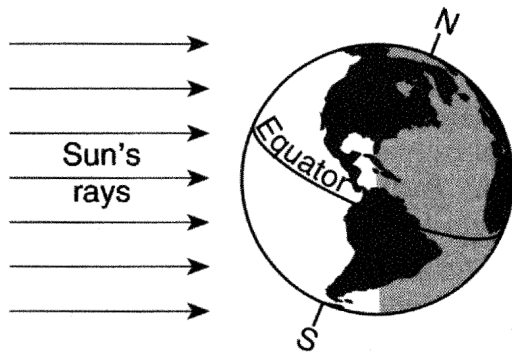
117. Base your answer to the following question on Letters A, B, C, D, and X on the map below represent locations on Earth. The map shows the latitude-longitude grid.



Solar time is based on the position of the Sun. If the solar time is 1 p.m. at location X, at which location is the solar time 5 p.m.?

- A A
- B B
- C C
- D D



118. The diagram below represents Earth in space on the first day of a season.

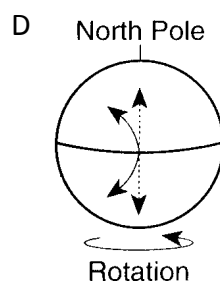
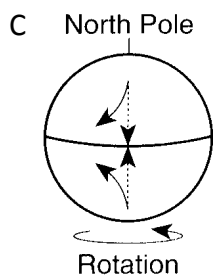
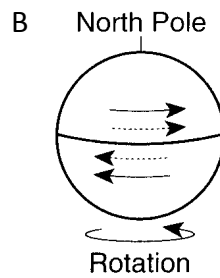
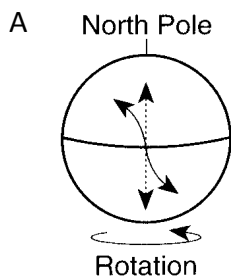


Which season is beginning in New York State on the day represented in the diagram?

- A winter      B spring      C summer      D fall

119. Which diagram correctly shows how surface winds are deflected (curved) in the Northern and Southern Hemispheres due to Earth's rotation?

Key	
	Original direction of wind
	Deflected path of wind



120. The day and the year, as units of time, are based upon motions of

- A the Earth      B the Moon      C the Sun      D distant stars

---

121. On March 21, at which location in New York State would sunrise occur first?

- A Riverhead      B Syracuse      C Buffalo      D Massena

122. Upon which frame of reference is time based?

- A the motions of the Earth      B the longitude of an observer  
C the motions of the Moon      D the real motions of the Sun

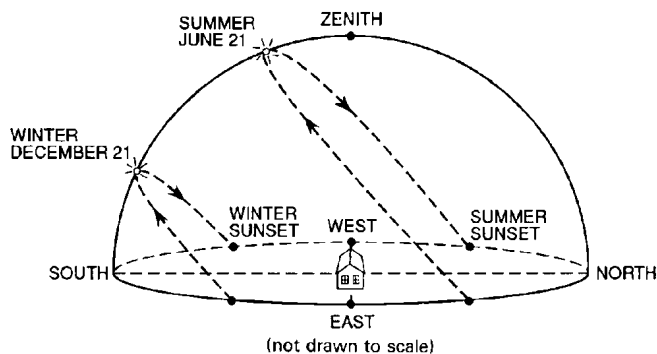
123. The apparent rising and setting of the Sun, as viewed from Earth, is caused by

- A Earth's rotation      B Earth's revolution  
C the Sun's rotation      D the Sun's revolution

124. Which statement best explains the apparent daily motion of the stars around *Polaris*?

- A The Earth's orbit is an ellipse.  
B The Earth has the shape of an oblate spheroid.  
C The Earth rotates on its axis.  
D The Earth revolves around the Sun.

125. The diagram below shows the apparent paths of the Sun in relation to a house in New York State on June 21 and December 21.



Which statement best explains the cause of this apparent change in the Sun's path?

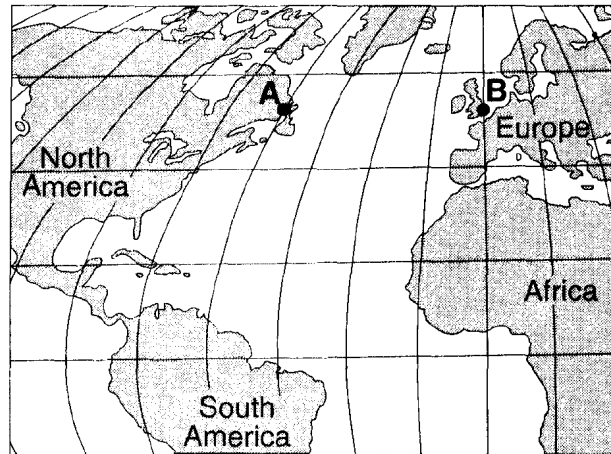
- A The Sun's orbital velocity changes as it revolves around the Earth.  
B The Earth's orbital velocity changes as it revolves around the Sun.  
C The Earth's axis is tilted  $23\frac{1}{2}^{\circ}$   
D The Sun's axis is tilted  $23\frac{1}{2}^{\circ}$
-

---

126. When observed from a location in Maine for one night, the North Star (*Polaris*) appears to

- A rise in the east and set in the west
- B rise in the west and set in the east
- C move southward along an arc-shaped path
- D remain stationary in the sky

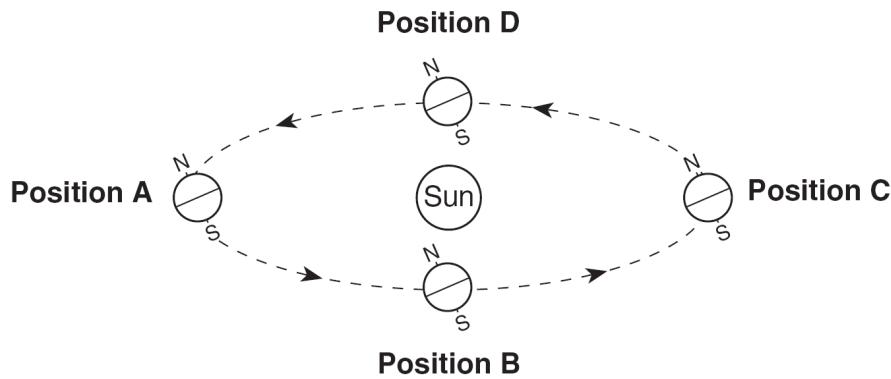
127. Base your answer to the following question on the map below, which shows locations *A* and *B* on Earth's surface at the same distance from the ocean, at the same elevation above sea level, and at the same latitude.



There is a four-hour solar time difference between locations *A* and *B*. What is the difference in longitude between locations *A* and *B*?

- A 15°
  - B 23.5°
  - C 45°
  - D 60°
-

- 
128. The diagram below shows Earth in its orbit around the Sun. Positions A, B, C, and D represent Earth at the beginning of each season.



(Not drawn to scale)

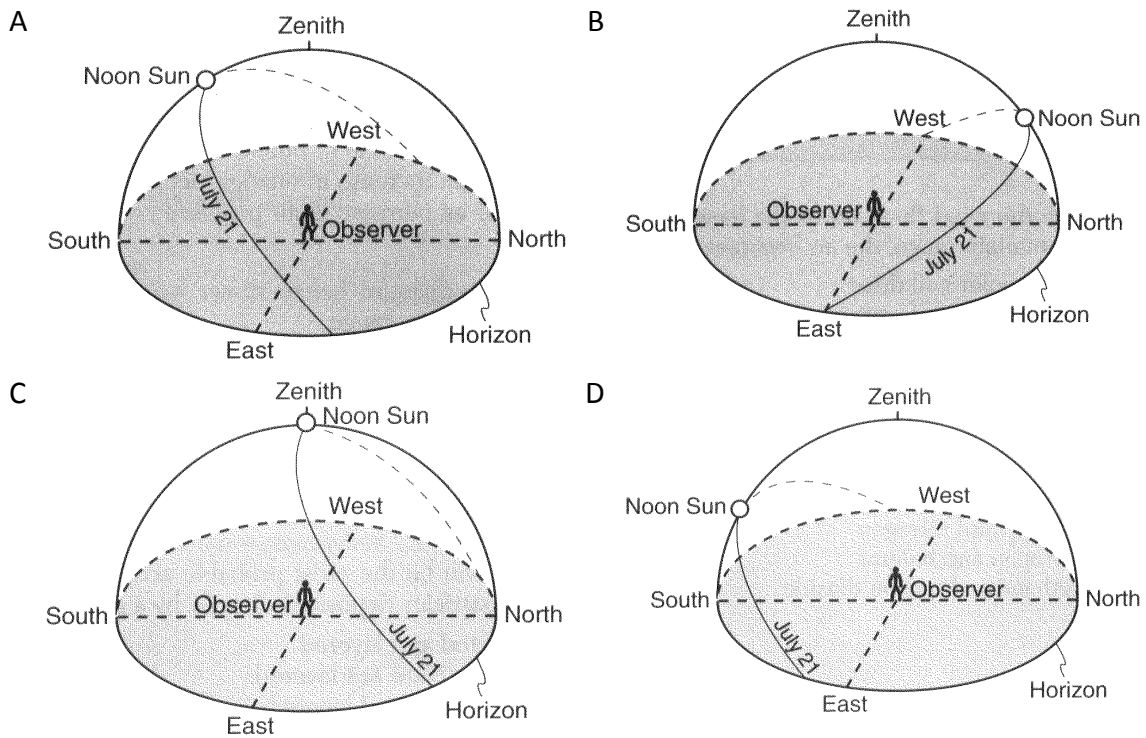
At which lettered position of Earth does New York State experience the first day of summer?

- A A                      B B                      C C                      D D

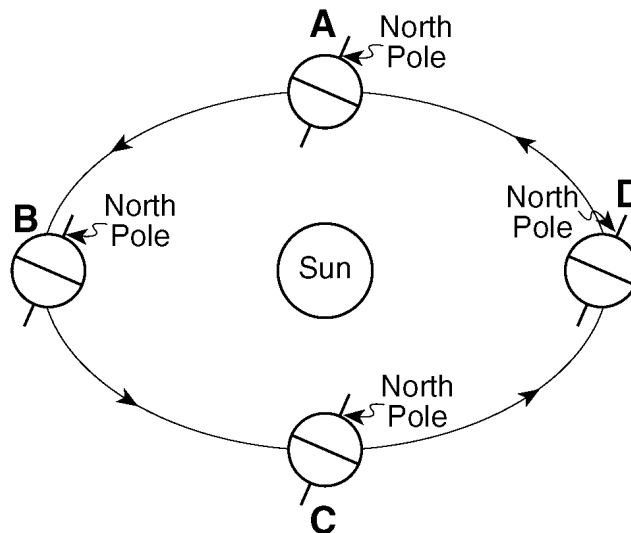
- 
129. The direction of swing of a Foucault pendulum appears to change due to Earth's

- A revolution                      B rotation  
C spherical shape                      D elliptical orbit
-

130. Which diagram best shows the Sun's apparent path, as seen by an observer on July 21 in New Jersey?



Base your answers to questions **131** and **132** on the diagram below, which represents an exaggerated view of Earth revolving around the Sun. Letters *A*, *B*, *C*, and *D* represent Earth's location in its orbit on the first day of each of the four seasons.



131. Which location in Earth's orbit represents the first day of fall (autumn) for an observer in Pennsylvania?

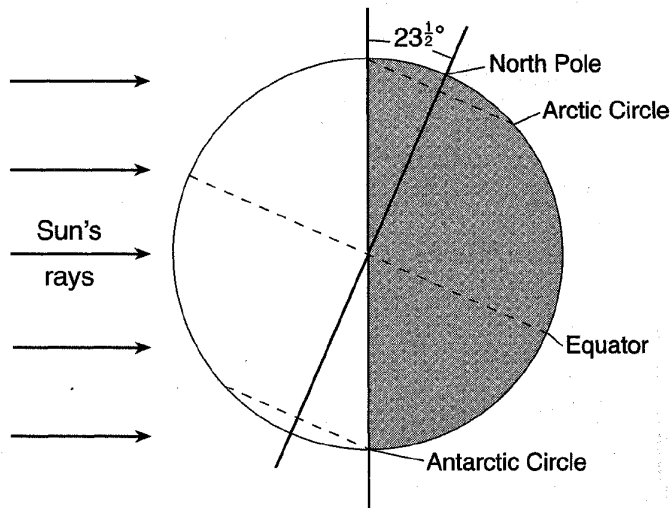
- A A      B B      C C      D D

---

132. Earth's rate of revolution around the Sun is approximately

- A  $1^\circ$  per day                      B  $360^\circ$  per day  
C  $15^\circ$  per hour                    D  $23.5^\circ$  per hour
- 

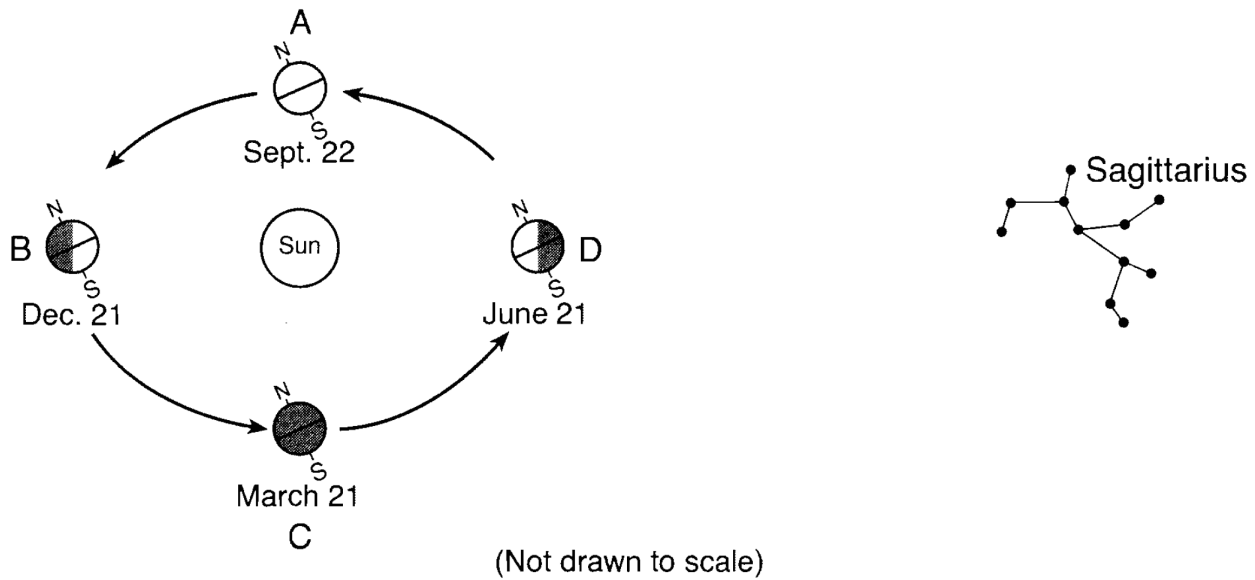
133. The diagram below shows Earth as viewed from space.



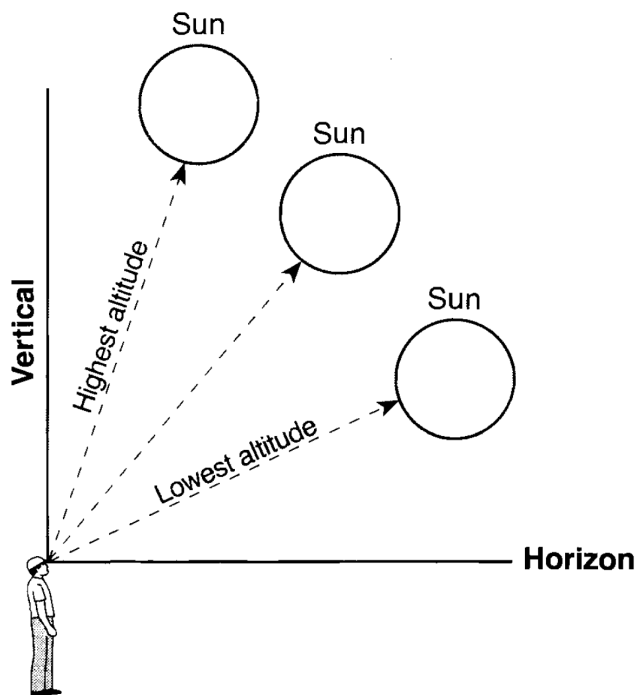
Which season is beginning in the Northern Hemisphere?

- A spring              B summer              C fall              D winter
-

Base your answers to questions **134** through **136** on the diagram of the Sun, Earth, and the constellation Sagittarius shown below. Positions *A* through *D* show Earth in its orbit around the Sun on the first day of each season. Sagittarius is represented in its position in space relative to Earth's orbit.



134. The diagram below shows the yearly range of altitudes of the noontime Sun as seen by an observer in New York State. Write the letters for each of the *four* Earth positions, *A*, *B*, *C*, and *D*, in the Sun circles on this diagram to identify when the observer will see the Sun at these noontime altitudes in New York State. More than one letter may be written in a circle.



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135. How many hours of daylight will an observer in New York State experience when Earth is at position C?

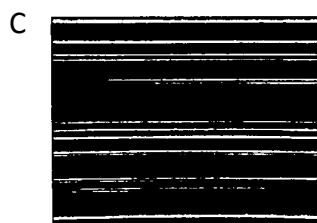
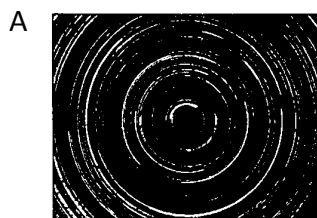
136. At which lettered position does Sagittarius appear highest in the sky at midnight to observers near Earth's equator?

---

137. Which change would occur if the Earth's rate of rotation were to increase?

- A The year would be shorter.
- B The day would be shorter.
- C The year would be longer.
- D The day would be longer.

138. Which photograph of star trails was taken by an observer facing directly north in New Jersey?



139. How long does Earth take to complete one orbit around the Sun?

- A 1 day
- B 1 month
- C 1 year
- D 1 decade

140. As Earth travels in its orbit, Earth's axis

- A remains parallel to itself at all Earth positions
  - B remains aligned with the Sun's axis
  - C is perpendicular to the Moon's axis
  - D is pointing toward the center of the Milky Way
-

---

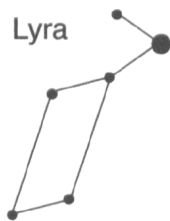
141. Evidence that Earth revolves around the Sun is provided by the

- A apparent rising and setting of the Sun during one day
- B apparent rising and setting of *Polaris* during one day
- C seasonal changes in the apparent positions of constellations
- D hourly changes in the apparent direction of the swing of a Foucault pendulum

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

- A rotation of Earth on its axis
- B unequal heating of Earth's surface
- C gravitational force of the Moon
- D gravitational force of the Sun

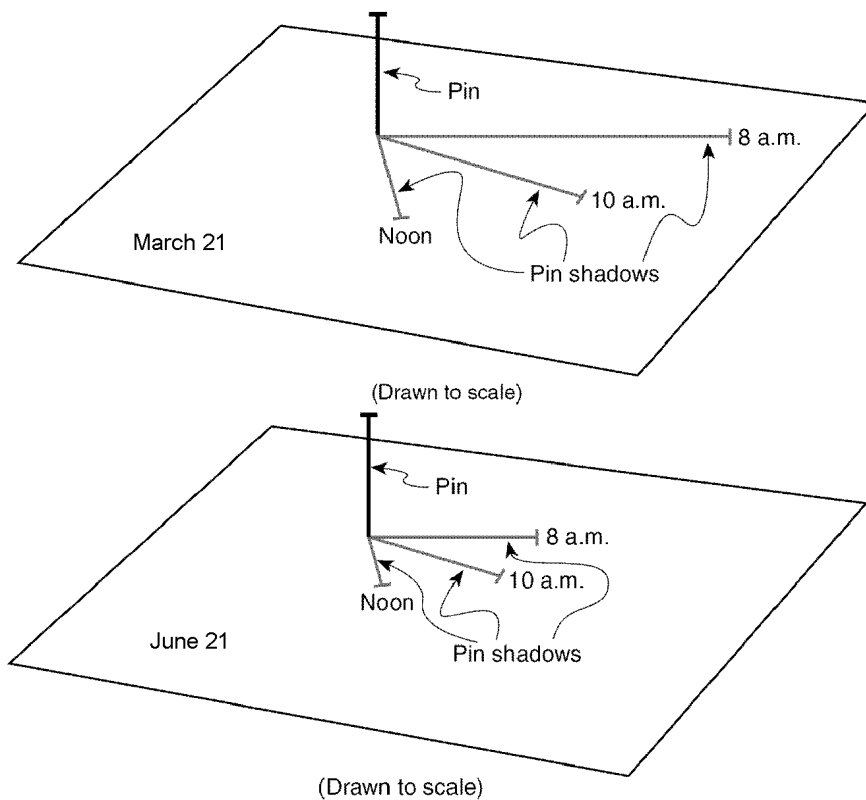
143. The diagram below represents the constellation Lyra.



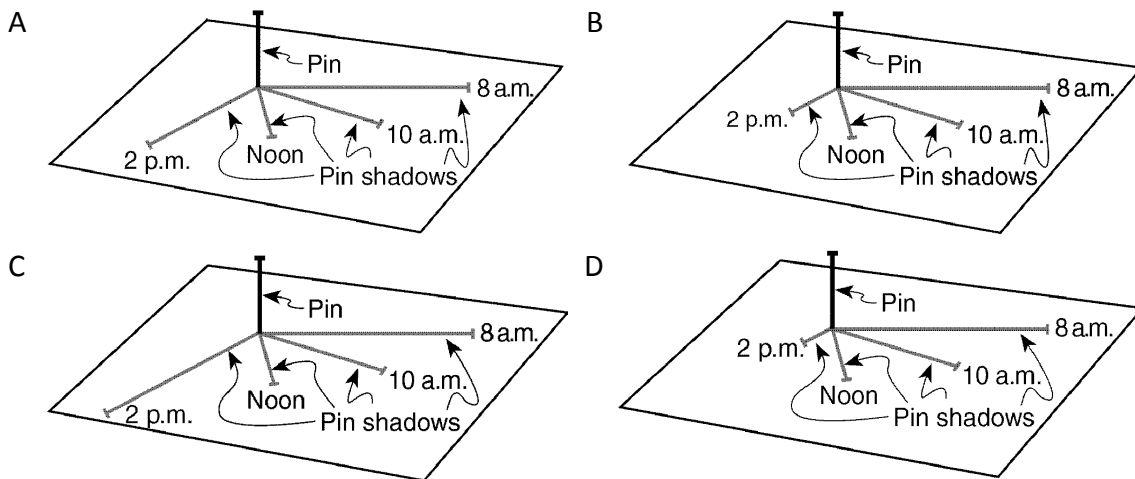
Which statement best explains why Lyra is visible to an observer in New York State at midnight in July but *not* visible at midnight in December?

- A Earth spins on its axis.
  - B Earth orbits the Sun.
  - C Lyra spins on its axis.
  - D Lyra orbits Earth.
-

Base your answers to questions **144** through **146** on the diagram below and on your knowledge of Earth science. The diagram shows a pin perpendicular to a card. The card was placed outdoors in the sunlight on a horizontal surface. The positions of the pin's shadow on the card were recorded several times on March 21 by an observer in New York State.



144. Which diagram best represents the length of the pin's shadow at 2 p.m. on March 21?



145. The changing location of the pin's shadow on March 21 is caused by

- A the Sun's rotation
- B the Sun's revolution
- C Earth's rotation
- D Earth's revolution

---

146. On June 21, the card and pin were placed in the same position as they were on March 21.  
The diagram above labeled June 21, shows the positions of the pin's shadow.

Which statement best explains the decreased length of each shadow on June 21?

- A The Sun's apparent path varies with the seasons.
  - B The Sun's distance from Earth varies with the seasons.
  - C The intensity of insolation is lower on June 21.
  - D The duration of insolation is shorter on June 21.
- 

147. Which motion causes the Coriolis effect on Earth?

- A revolution of Earth around the Sun
- B revolution of the Moon around Earth
- C rotation of Earth on its axis
- D rotation of the Moon on its axis

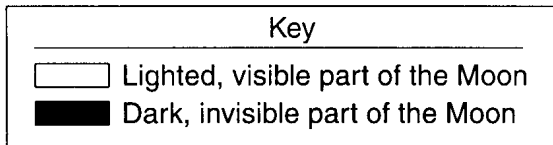
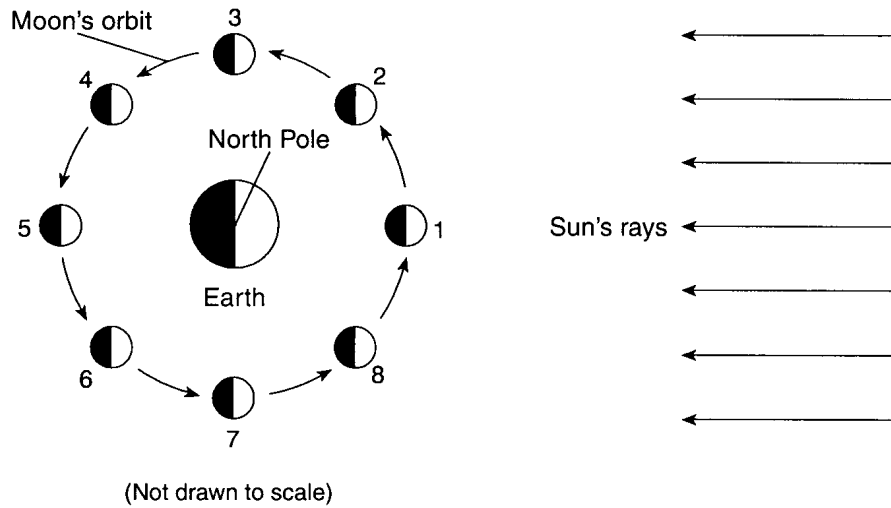
148. In the Northern Hemisphere, planetary winds deflect to the

- A right, due to the Coriolis effect
- B right, due to the Doppler effect
- C left, due to the Coriolis effect
- D left, due to the Doppler effect

149. The Foucault pendulum provides evidence of Earth's

- A revolution around the Sun in a geocentric solar system
  - B revolution around the Sun in a heliocentric solar system
  - C rotation on its axis in a geocentric solar system
  - D rotation on its axis in a heliocentric solar system
-

150. Base your answer to the following question on the diagram below, which represents the Moon orbiting Earth as viewed from space above the North Pole. The Moon is shown at eight different positions in its orbit.



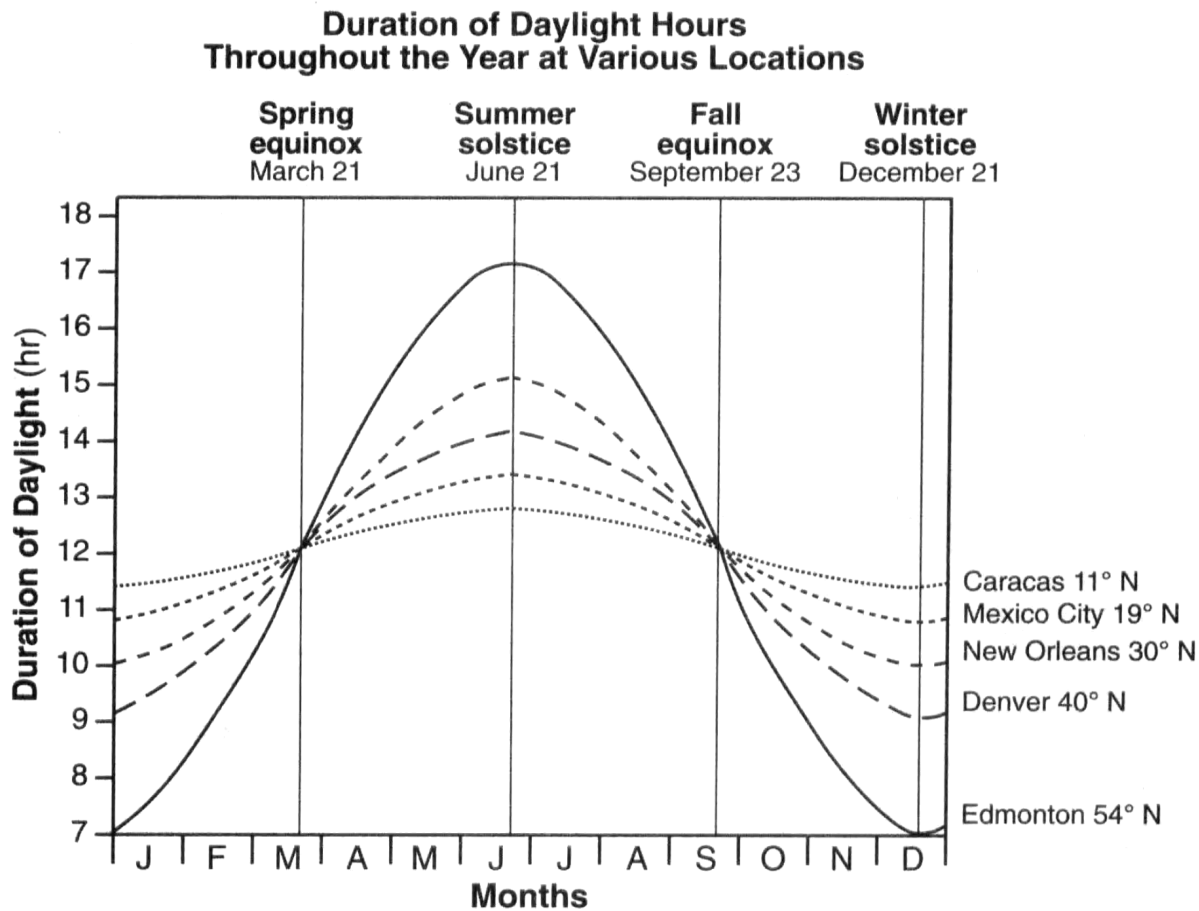
Which device when placed on the Moon would provide evidence of Moon rotation?

- |                     |               |
|---------------------|---------------|
| A Foucault pendulum | B seismograph |
| C thermometer       | D wind vane   |

151. A student read in a newspaper that the maximum length of the daylight period for the year in Pittsburgh, Pennsylvania, had just been reached. What was the date of this newspaper?

- A March 22      B June 22      C September 22      D December 22

Base your answers to questions **152** and **153** on the graph below, which shows the duration of daylight hours throughout the year for five cities located in the Northern Hemisphere.



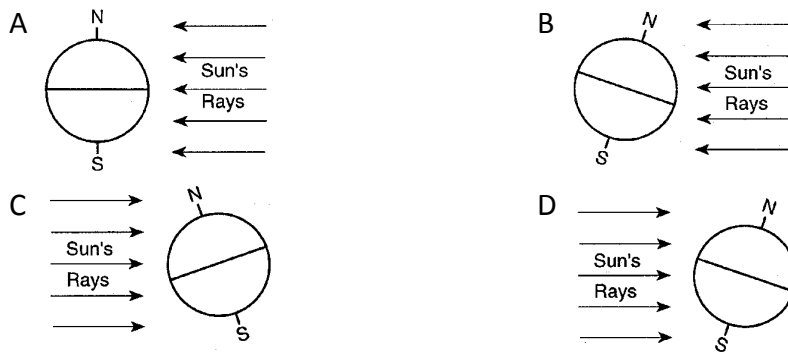
152. Which city experiences the greatest variation in daylight hours during one year?

- A Caracas      B Mexico City      C New Orleans      D Edmonton

153. What is the primary reason each city's duration of daylight hours changes throughout the year?

- A Earth's axis is tilted  $23.5^\circ$  to the plane of its orbit.  
B Earth's rotation rate is  $15^\circ$  per day.  
C The cities are located at different longitudes.  
D The cities are located at different elevations.

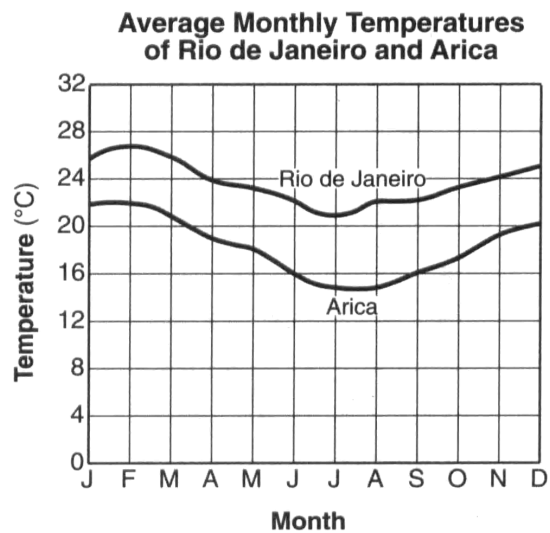
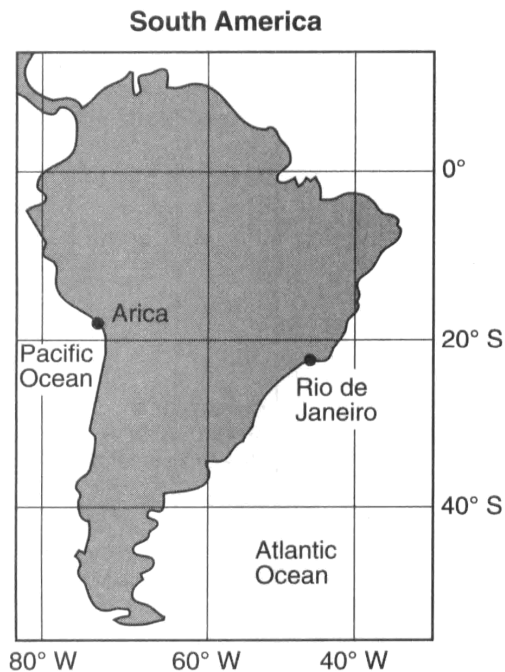
154. Which diagram shows the position of the Earth relative to the Sun's rays during a winter day in the Northern Hemisphere?



155. In New York State, the constellation Pisces can be seen in the night sky between the middle of summer and the middle of winter. The constellation Scorpio can be seen in the night sky between early spring and early fall. The reason these two constellations can be viewed only at these times is a direct result of Earth's

- |                                   |                           |
|-----------------------------------|---------------------------|
| A spin on its axis                | B movement around the Sun |
| C axis having a $23.5^\circ$ tilt | D distance from the Sun   |

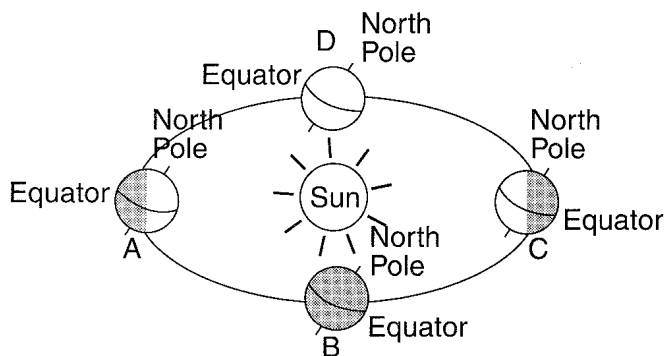
156. Base your answer to the following question on the map and graph below. The map shows two cities, Arica and Rio de Janeiro, located on opposite coasts of South America. Both cities are near sea level. The graph shows the average monthly temperatures for the cities.



The summer season at Arica and Rio de Janeiro occurs from approximately

- A March 21 through June 20      B June 21 through September 22  
C September 23 through December 20      D December 21 through March 20

157. The diagram below represents Earth at four different positions, A, B, C, and D, in its orbit around the Sun.



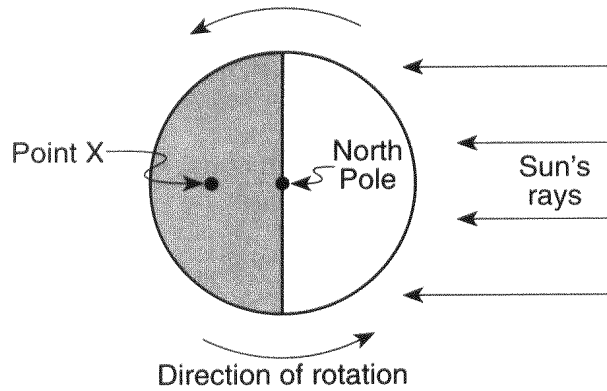
(Not drawn to scale)

Between which positions would Texas be experiencing the summer season?

- A A and B      B B and C      C C and D      D D and A

---

158. The diagram below represents the direction of Earth's rotation as it appears from above the North Pole. Point X is a location on Earth's surface.



The time at point X is closest to

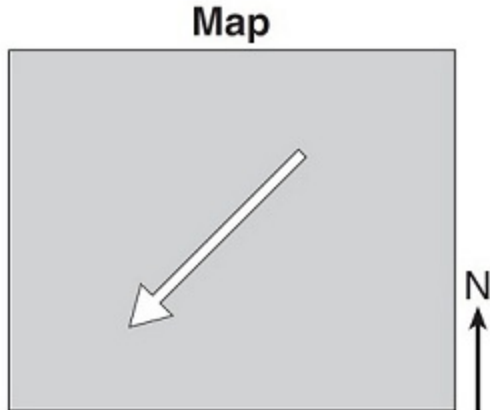
- A 9 a.m.      B 12 noon      C 9 p.m.      D 12 midnight

---

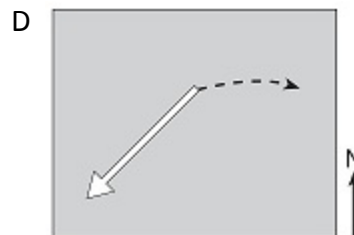
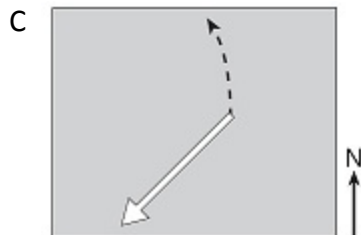
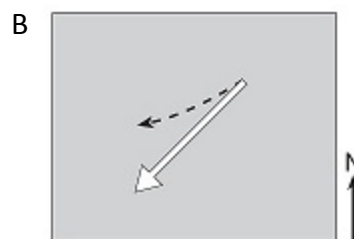
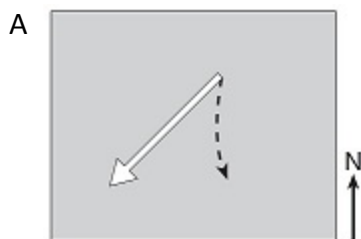
159. The Coriolis effect provides evidence that Earth

- A rotates      B has a tilted axis  
C has seasons      D revolves
-

160. The arrow on the map below represents the direction a wind is blowing over a land surface in the Northern Hemisphere *without* showing the Coriolis effect.



Which dashed arrow represents how the wind direction will change in the Northern Hemisphere due to the Coriolis effect?



161. During how many days of a calendar year is the Sun directly overhead at noon in New Jersey?

A only 1 day      B only 2 days      C 365 days      D 0 days

162. If the Earth's rate of rotation decreased, there would be an increase in the

A length of the seasons      B Sun's angle of insolation at noon  
C number of observable stars at night      D length of time for one Earth day

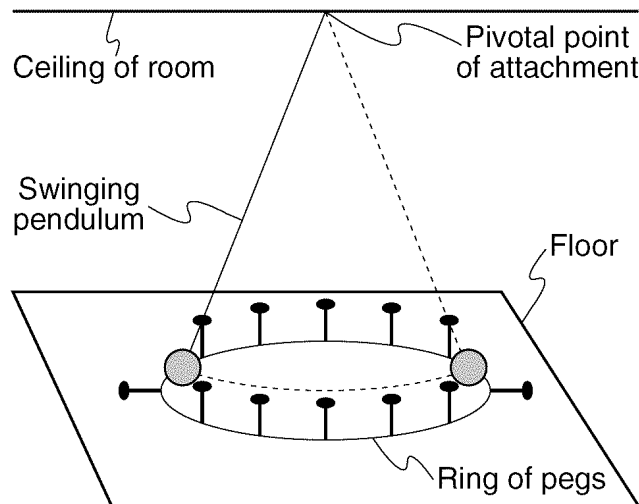
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163. During which month does the Sun appear to rise farthest north of due east for an observer in New York State?

- A December      B January      C June      D July

---

164. The diagram below represents a swinging Foucault pendulum.

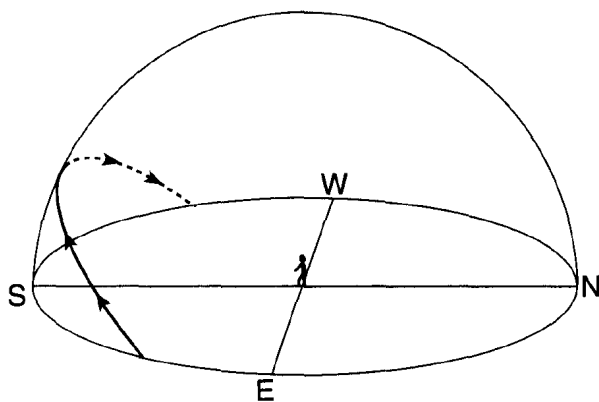


This pendulum will show an apparent change in the direction of its swing due to Earth's

- A curved surface      B tilted axis  
C rotation      D revolution

---

165. The model below shows the Sun's apparent path across the sky for an observer in New York State.



On which day of the year was this path observed?

- A March 21      B June 21      C September 21      D December 21
-

---

166. On which day of the year does the Sun reach the greatest altitude at solar noon in New York City?

- A June 21                  B July 21                  C August 21                  D September 21

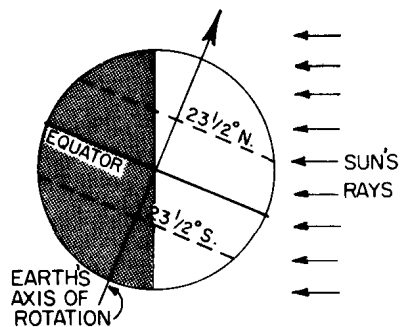
167. To an observer in New York State, the duration of daylight increases continuously from

- A March 1 to May 1                                  B June 1 to August 1  
C September 1 to November 1                      D December 1 to February 1

168. In order to describe the apparent daily motion of stars, a person must observe the

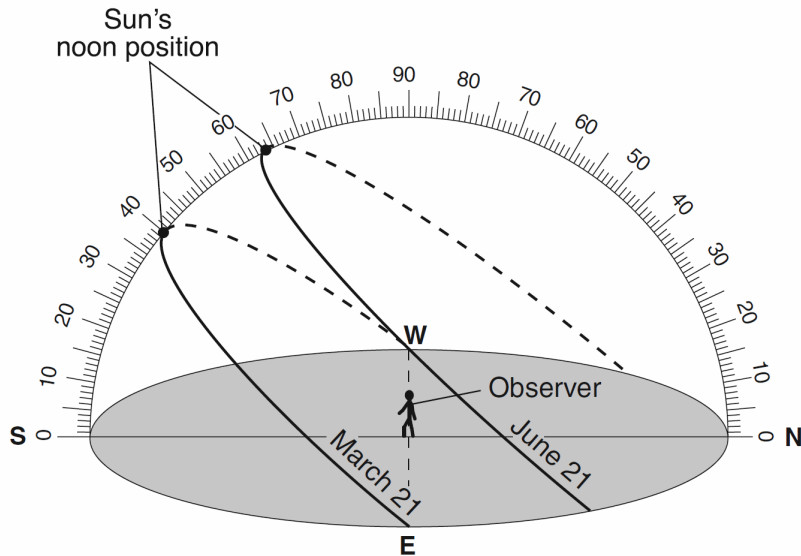
- A locations of several stars at the same time  
B brightness of several stars over a period of time  
C position of one particular star at one particular time  
D position of one star relative to the horizon over a period of time

169. In the diagram below, the direct rays of the Sun are striking the Earth's surface at  $23\frac{1}{2}^{\circ}$  N. What is the date shown in the diagram?



- A March 21                  B June 21                  C September 23                  D December 21
-

Base your answers to questions **170** through **173** on diagram and data table below. The diagram represents the Sun's apparent paths as viewed by an observer located at 50° N latitude on June 21 and March 21. The data table shows the Sun's maximum altitude for the same two dates of the year. The Sun's maximum altitude for December 21 has been left blank.



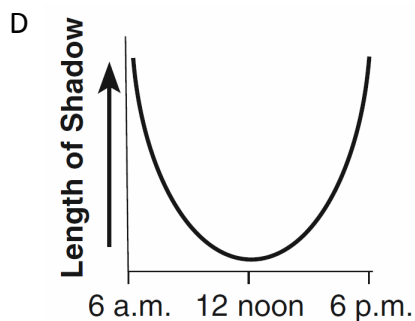
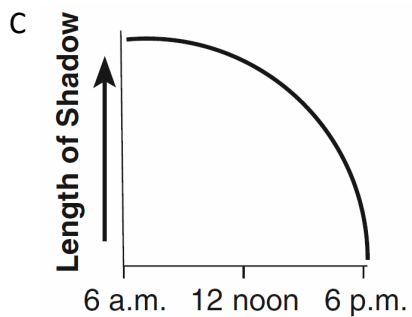
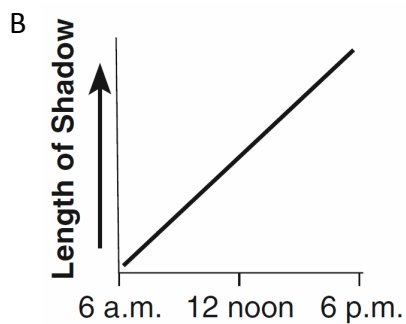
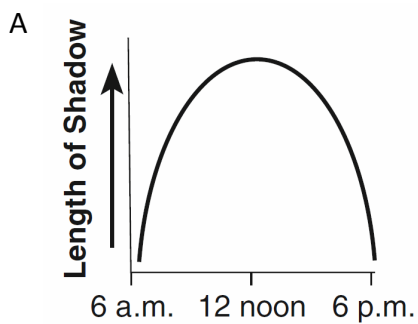
**Data Table**

Date	Sun's Maximum Altitude
June 21	63.5°
March 21	40°
December 21	

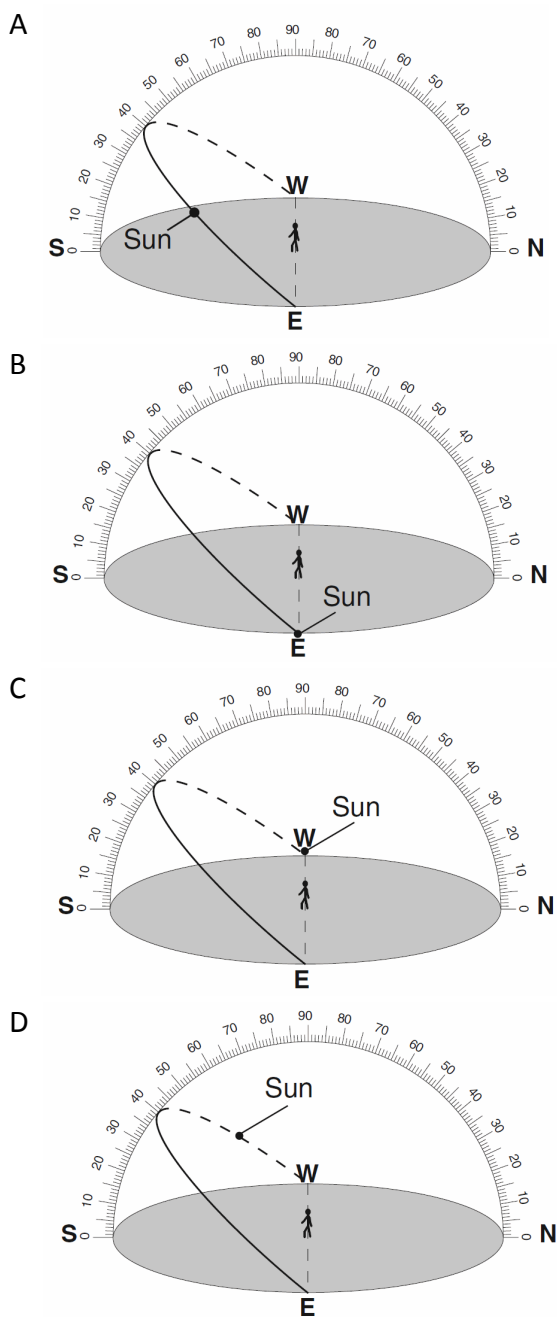
170. Which statement best compares the intensity and angle of insolation at noon on March 21 and June 21?

- A The intensity and angle of insolation are greatest on March 21.
- B The intensity and angle of insolation are greatest on June 21.
- C The intensity of insolation is greatest on June 21 and the angle of insolation is greatest on March 21.
- D The intensity of insolation is greatest on March 21 and the angle of insolation is greatest on June 21.

171. Which graph best represents the relationship between the time of day and the length of a shadow cast by the observer on March 21?



172. Which diagram represents the approximate location of the Sun at 3 p.m. on March 21?



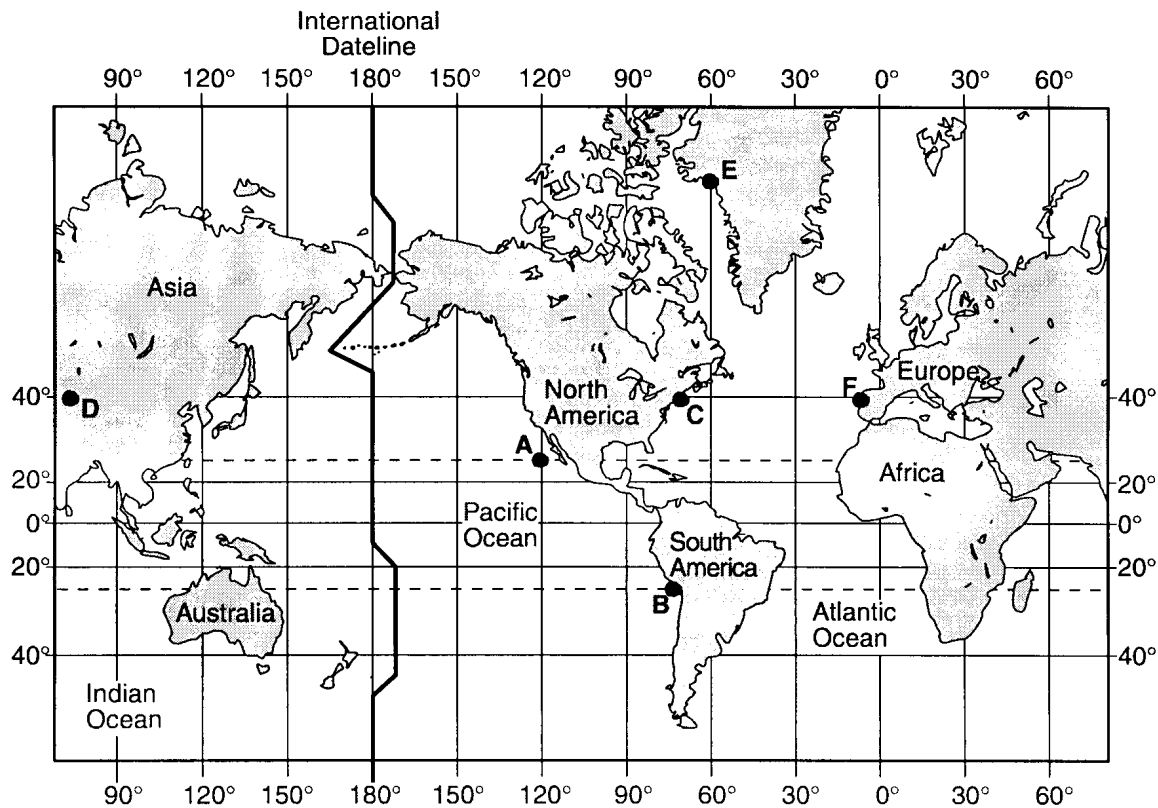
173. Which value should be placed in the data table for the Sun's maximum altitude on December 21?

- A 16.5°      B 23.5°      C 40°      D 90°

174. Earth's rate of rotation is approximately

- A  $1^\circ$  per day      B  $15^\circ$  per day      C  $180^\circ$  per day      D  $360^\circ$  per day

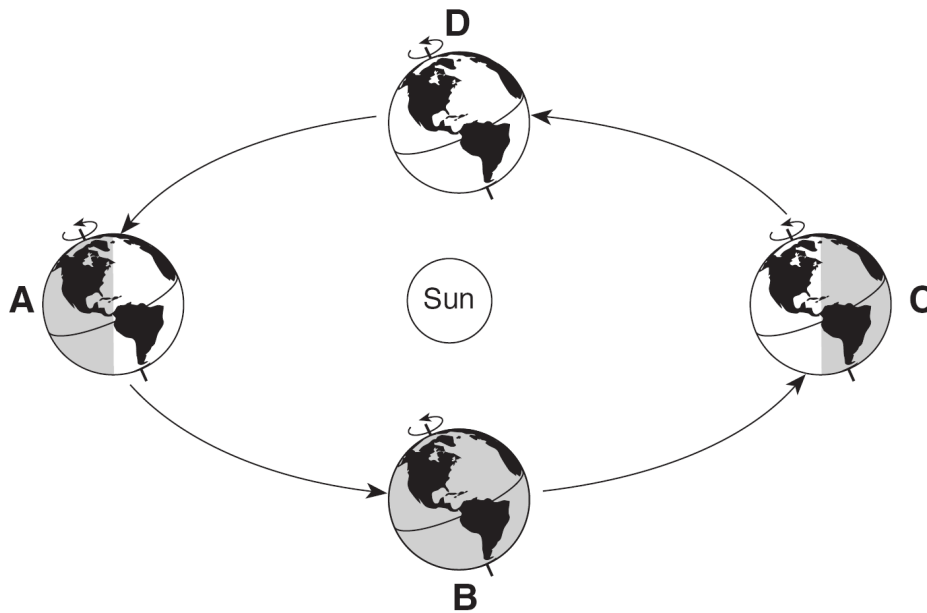
175. Base your answer to the following question on the map below. Letters A through F are locations on Earth's surface.



When solar time at location E is 12 noon, solar time at location A is closest to

- A 6 a.m.      B 8 a.m.      C 12 noon      D 4 p.m.

Base your answers to questions **176** through **178** on the diagram below, which shows a model of Earth's orbit around the Sun. Letters *A*, *B*, *C*, and *D* represent Earth's position at the beginning of each season.



(Not drawn to scale)

\_\_\_\_\_ 176. Which position of Earth represents the first day of summer in the Northern Hemisphere?

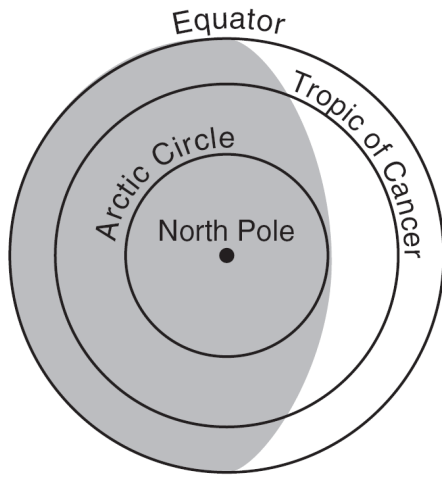
- A *A*                      B *B*                      C *C*                      D *D*

\_\_\_\_\_ 177. How many degrees will the Sun's vertical rays shift on Earth's surface as Earth travels from position *C* to position *D*?

- A  $15^\circ$                       B  $23.5^\circ$                       C  $47^\circ$                       D  $365^\circ$

---

178. The diagram below shows how Earth is illuminated [lighted] by the Sun as viewed from above the North Pole.



In which orbital position would Earth be illuminated as shown?

A A

B B

C C

D D

---

179. A Foucault pendulum appears to change its direction of swing due to the

A tilt of Earth's axis

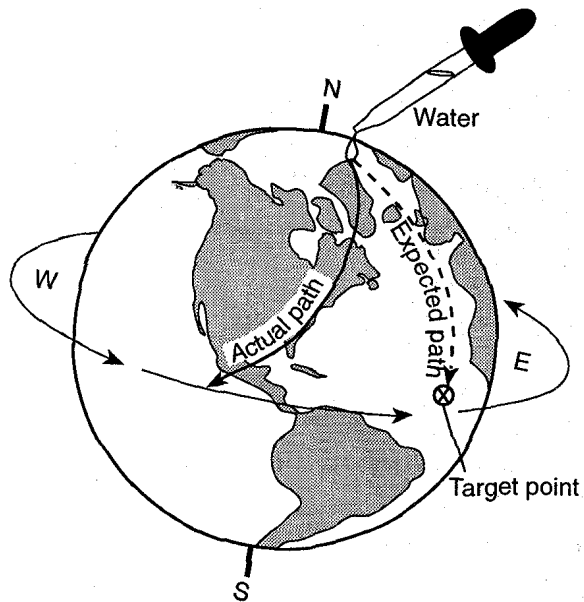
B spin of Earth on its axis

C deflection of Earth's planetary winds

D movement of Earth in its orbit around the Sun

---

180. The diagram below represents an activity in which an eye dropper was used to place a drop of water on a spinning globe. Instead of flowing due south toward the target point, the drop followed a curved path and missed the target.



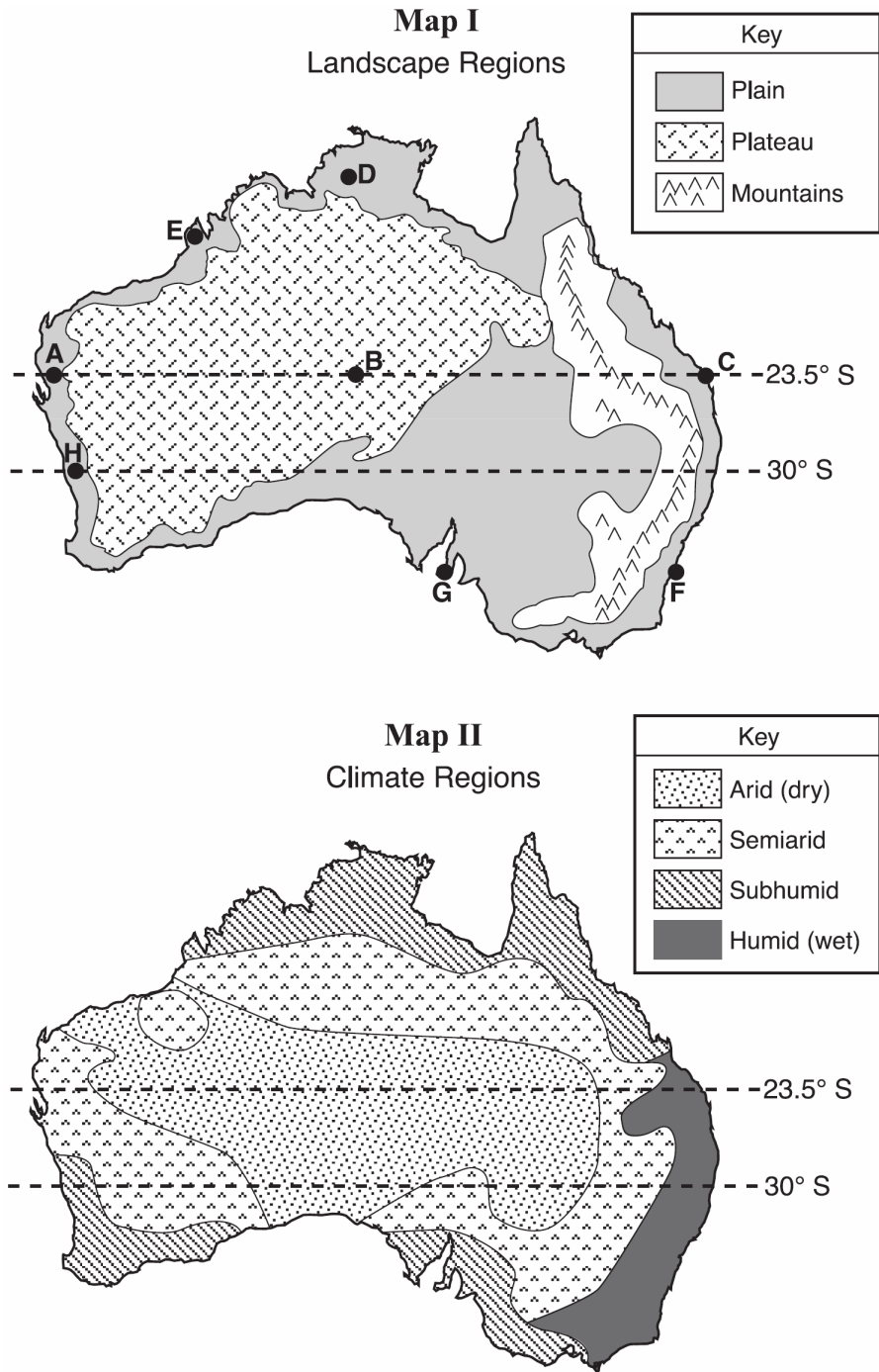
The actual path results from

- |                                |                       |
|--------------------------------|-----------------------|
| A the tilt of the globe's axis | B the Coriolis effect |
| C the globe's revolution       | D dynamic equilibrium |

181. The Coriolis effect causes winds in New York State to generally curve

- |   |  |
|---|--|
| A to the right of the direction of travel | B to the left of the direction of travel |
| C upward away from Earth's surface        | D downward toward Earth's surface        |

182. Base your answer to the following question on the two maps for Australia below. Map I shows Australia's major landscape regions. Letters A through H represent locations in Australia. Map II shows Australia's general climate regions.



On which day with the noon Sun be directly overhead at location C?

- A March 21      B June 21      C September 23      D December 21

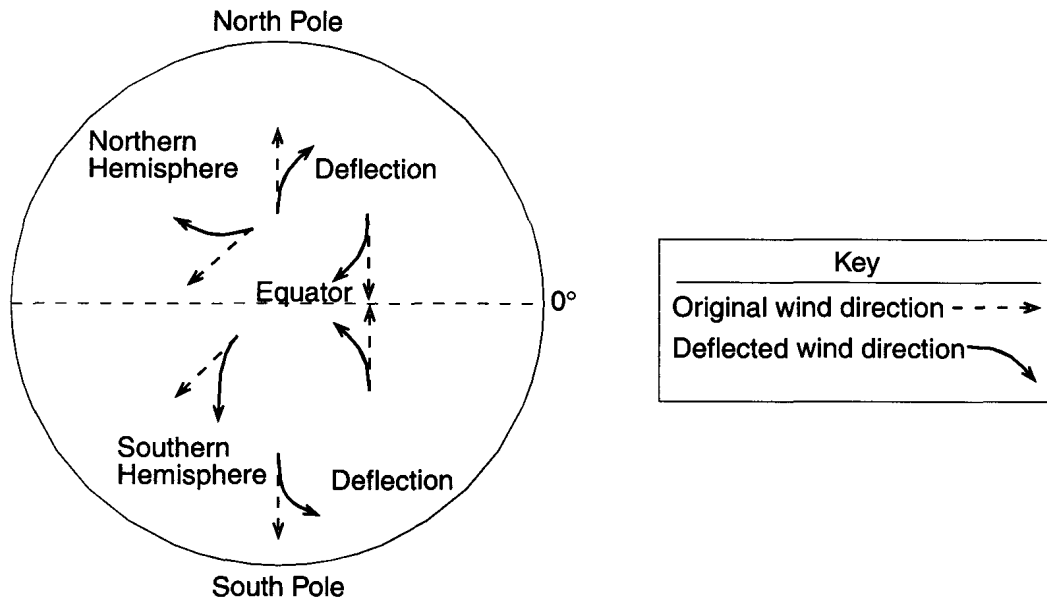
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183. Which statement provides evidence that Earth revolves around the Sun?

- A Winds at different latitudes are curved different amounts by the Coriolis effect.
- B Different star constellations are visible from Earth at different seasons of the year.
- C The Sun follows an apparent arc across the sky during the day.
- D The stars appear to circle Earth during the night.

---

184. The diagram below shows some examples of how surface winds are deflected in the Northern and Southern Hemispheres because of Earth's rotation.



Earth's rotation causes winds to be deflected to the

- A right in both the Northern and Southern Hemispheres
- B right in the Northern Hemisphere and left in the Southern Hemisphere
- C left in the Northern Hemisphere and right in the Southern Hemisphere
- D left in both the Northern and Southern Hemispheres

---

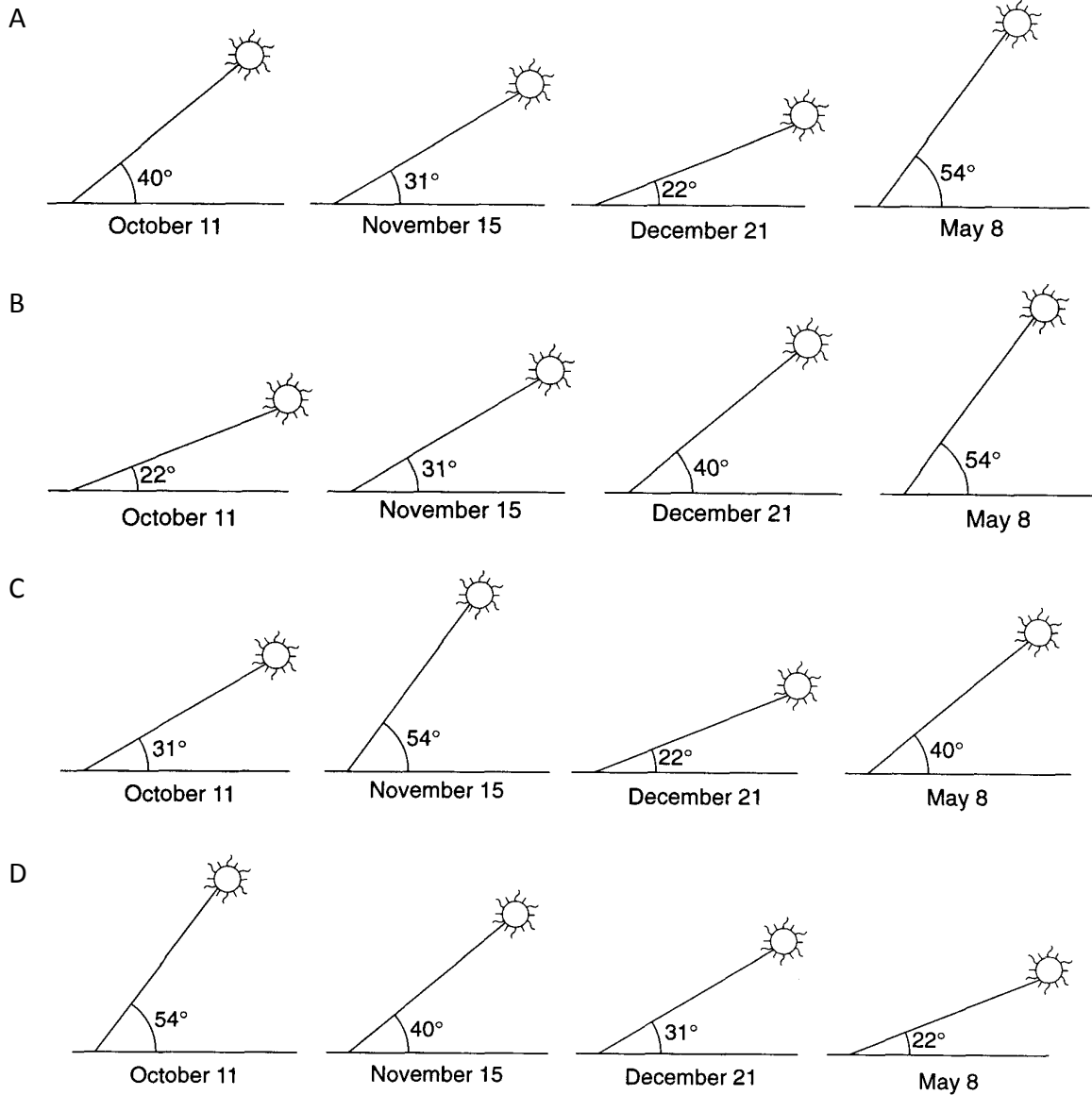
185. Ocean currents exhibit the Coriolis effect as a result of the

- A rotation of the Earth
  - B revolution of the Earth
  - C unequal heating of the Earth
  - D variations in salinity of the Earth's oceans
-

186. Which motion is responsible for the regular seasonal changes of the constellations visible in the night sky?

- A The stars orbit Earth.                      B The stars orbit the Sun.  
C The Moon orbits Earth.                    D Earth orbits the Sun.

187. A student accurately measured the altitude of the noontime Sun from the same New Jersey location on four days during the school year. Which sequence best shows these measurements?



---

188. The path of a Foucault pendulum provides evidence that Earth

- A rotates on its axis
- B revolves in its orbit
- C is tilted on its axis
- D has an elliptical orbit

189. If Earth's rate of rotation increases, the length of one Earth day will be

- A shorter than 24 hours
- B longer than 24 hours
- C 24 hours, with a shorter nighttime period
- D 24 hours, with a longer nighttime period

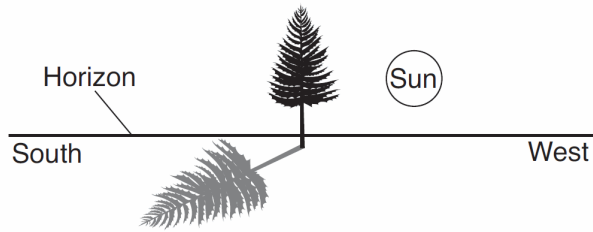
190. Which two factors cause the perpendicular rays of the Sun to move between 23.5° N and 23.5° S?

- A tilt of Earth's axis and Earth's revolution
- B tilt of Earth's axis and Earth's rotation
- C eccentricity of Earth's orbit and Earth's revolution
- D eccentricity of Earth's orbit and Earth's rotation

191. Which observation is a direct result of the 23½° tilt of Earth's axis as Earth orbits the Sun?

- A Locations on Earth's Equator receive 12 hours of daylight every day.
  - B The apparent diameter of the Sun shows predictable changes in size.
  - C A Foucault pendulum shows predictable shifts in its direction of swing.
  - D Winter occurs in the Southern Hemisphere at the same time that summer occurs in the Northern Hemisphere.
-

192. A tree in New York State casts a shadow as shown in the diagram below.



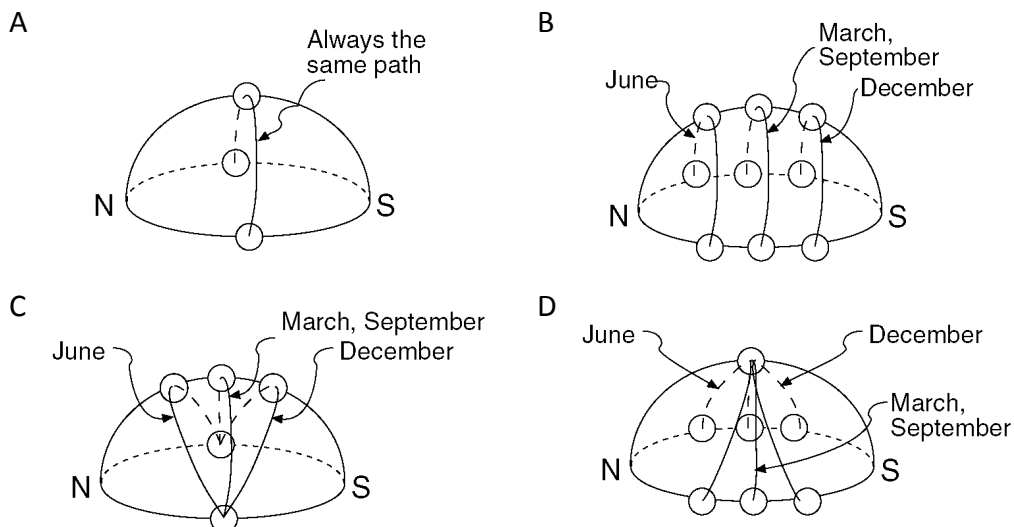
What time of day and season are represented by the diagram?

- A early morning in winter
- B early morning in summer
- C late afternoon in winter
- D late afternoon in summer

193. A Foucault pendulum appears to change its direction of swing over a period of several hours because of Earth's

- A rotation
- B revolution
- C tilted axis
- D gravity

194. Which model best represents the apparent path of the Sun observed at various times during the year at the Equator?



195. How many degrees does the Sun appear to move across the sky in four hours?

- A 60°
- B 45°
- C 15°
- D 4°

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196. Which statement best describes the position of the Sun at sunrise and sunset as seen by an observer in New York State on June 21?

- A The Sun rises north of due east and sets north of due west.
- B The Sun rises south of due east and sets south of due west.
- C The Sun rises north of due east and sets south of due west.
- D The Sun rises south of due east and sets north of due west.

197. The best evidence that Earth rotates on its axis is the changing

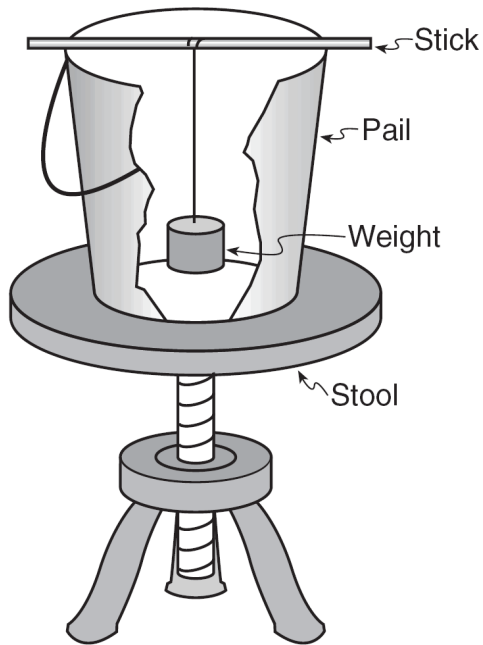
- A phases of the Moon
- B altitude of the noontime Sun from day to day
- C apparent path of a Foucault pendulum
- D velocity of Earth in its orbit

198. In 1851, the French physicist Jean Foucault constructed a large pendulum that always changed its direction of swing at the same rate in a clockwise direction. According to Foucault, this change in direction of swing was caused by the

- |                                |                                      |
|--------------------------------|--------------------------------------|
| A Moon's rotation on its axis  | B Moon's revolution around the Earth |
| C Earth's rotation on its axis | D Earth's revolution around the Sun  |
-

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199. The diagram below shows the equipment used to demonstrate a Foucault pendulum.



In the demonstration, a student swings the weight hanging in the pail and then spins the stool. The stool represents

- A the revolving Earth
- B the rotating Earth
- C the Coriolis effect
- D convection currents

200. A Foucault pendulum is used to prove that

- A the Sun rotates on its axis
- B the Sun revolves around Earth
- C Earth rotates on its axis
- D Earth revolves around the Sun

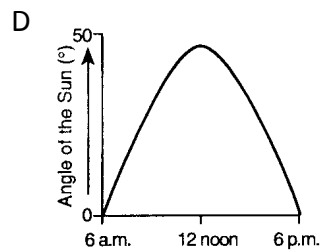
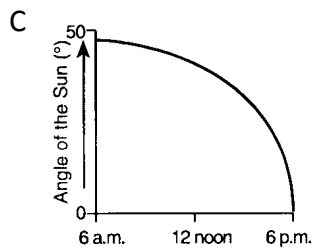
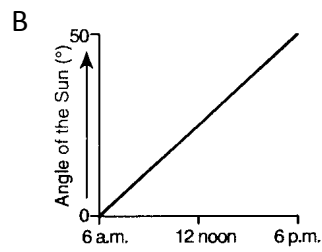
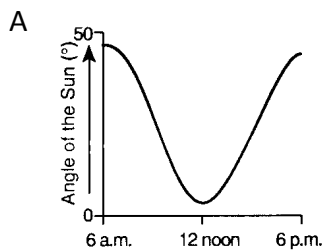
201. The motion of a Foucault pendulum provides evidence that Earth

- A varies in distance from the Sun
- B is tilted on its axis
- C spins on its axis
- D travels around the Sun

202. On June 21, where will the Sun appear to rise for an observer located in New Jersey?

- A due west
  - B due east
  - C north of due east
  - D south of due east
-

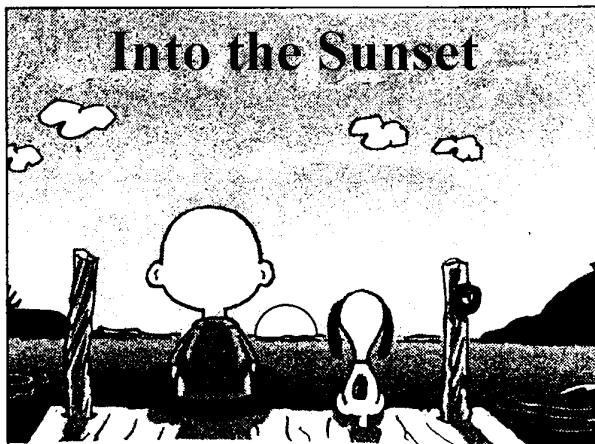
203. Which graph best represents the angle of the Sun above the horizon as observed from 6 a.m. to 6 p.m. on September 23 at a location in New York State?



204. As viewed from Earth, most stars appear to move across the sky each night because

- A Earth revolves around the Sun
- B Earth rotates on its axis
- C stars orbit around Earth
- D stars revolve around the center of the galaxy

205. The cartoon characters below are watching the Sun set.



Toward which general direction are the characters looking?

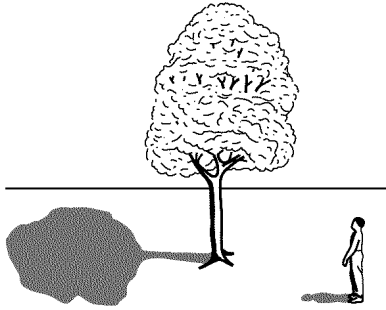
- A north
- B south
- C east
- D west

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206. What is the total number of degrees that the Earth rotates on its axis during a 12-hour period?

- A  $1^\circ$                       B  $15^\circ$                       C  $180^\circ$                       D  $360^\circ$

207. The diagram below shows the noontime shadows cast by a student and a tree.



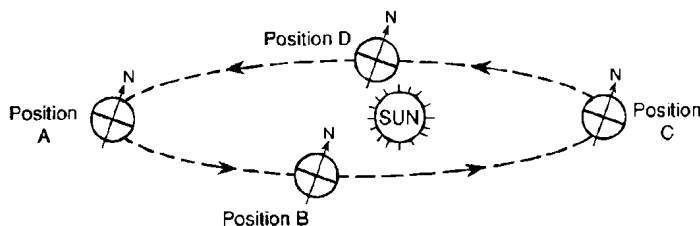
If the time is solar noon and the student is located in New York State, in what direction is the student facing?

- A north                      B south                      C east                      D west

208. The spinning of Earth on its axis causes the apparent rising and setting of the

- A Sun, only                                      B Sun and the Moon, only  
C Moon and some stars, only                      D Sun, the Moon, and some stars

209. The diagram below represents four positions of the Earth as it revolves around the Sun.



(NOT DRAWN TO SCALE)

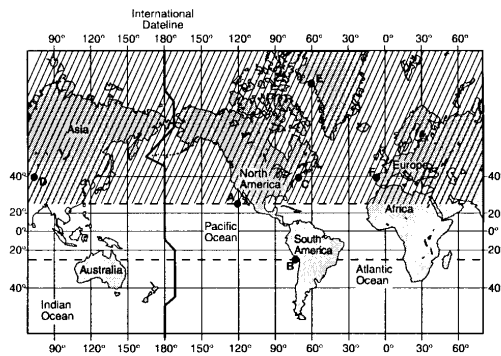
At which position is the Earth located on December 21?

- A A                      B B                      C C                      D D
-

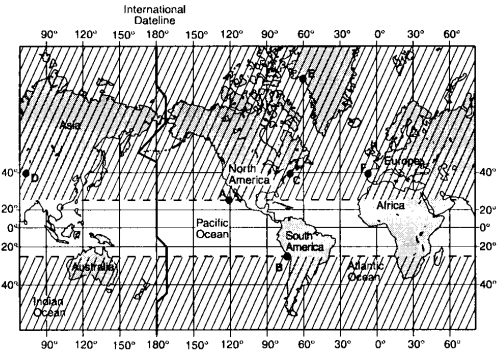


212. In which map does the shaded area correctly represent the part of Earth that receives direct (perpendicular) rays from the Sun sometime during the year?

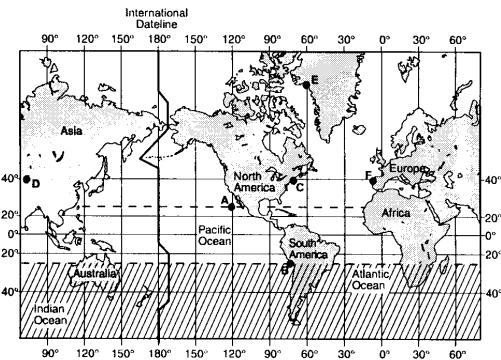
A



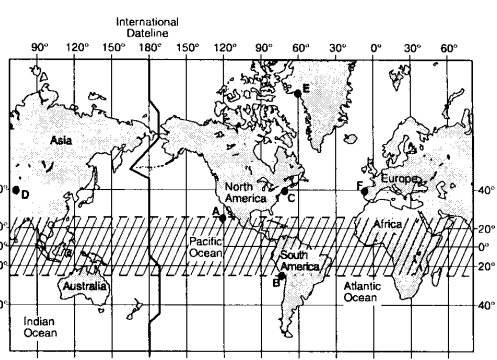
B



C



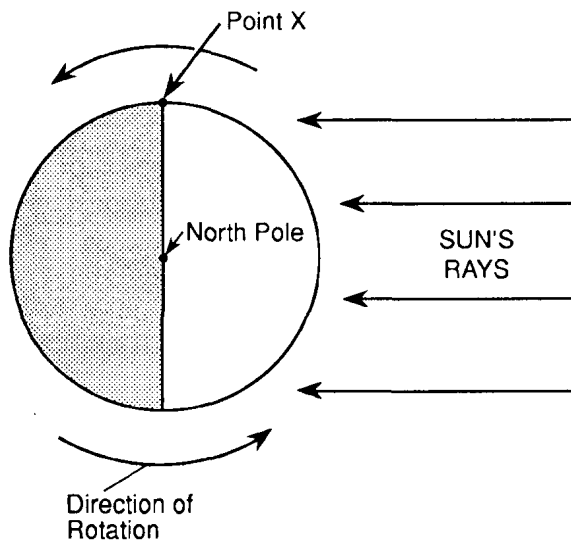
D



213. In October, observers in Ohio looking due south at the night sky would see a different group of constellations than they had seen in March. What is the best explanation for this change in the night sky?

- A Constellations revolve around Earth.
- B Constellations revolve around the Sun.
- C The Sun revolves around the center of our galaxy.
- D Earth revolves around the Sun.

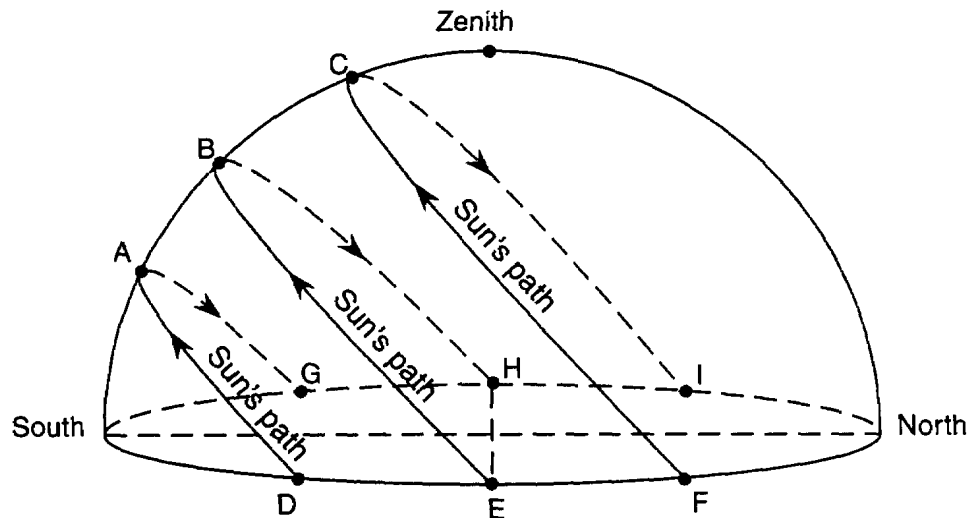
- 
214. The diagram below shows the rotating Earth as it would appear from a satellite over the North Pole.



The time at point X is closest to

- A 6 a.m.              B 12 noon              C 6 p.m.              D 12 midnight
215. Which observable change would occur in New York State if Earth's rate of rotation were one-half its present rate?
- A The Sun would rise in the southwest each day.  
B The length of a day would be longer.  
C The time needed to complete a cycle of Moon phases would be greater.  
D The seasonal changes would not occur.
-

216. The diagram below represents a plastic hemisphere upon which lines have been drawn to show the apparent paths of the Sun at a location in New York State on the first day of each season. Letters A through I represent points on the paths.



Which point represents the sunrise location on the first day of winter?

- A G                      B F                      C E                      D D

217. Which observation provides the best evidence that Earth revolves around the Sun?

- A The constellation Orion is only visible in the night sky for part of the year.
- B The North Star, *Polaris*, is located above the North Pole for the entire year.
- C The Sun appears to move across Earth's sky at
- D The Coriolis effect causes Northern Hemisphere winds to curve to the right.

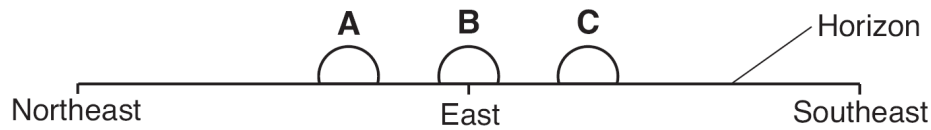
218. The apparent daily path of the Sun changes with the seasons because

- A Earth's axis is tilted
- B Earth's distance from the Sun changes
- C the Sun revolves
- D the Sun rotates

219. Planetary winds and ocean currents are deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere due to

- A seasonal changes
- B plate tectonics
- C the Doppler effect
- D the Coriolis effect

- 
220. A student in New York State looked toward the eastern horizon to observe sunrise at three different times during the year. The student drew the following diagram that shows the positions of sunrise, A, B, and C, during this one-year period.



Which list correctly pairs the location of sunrise to the time of the year?

- A A—June 21  
B—March 21  
C—December 21
- B A—December 21  
B—March 21  
C—June 21
- C A—March 21  
B—June 21  
C—December 21
- D A—June 21  
B—December 21  
C—March 21

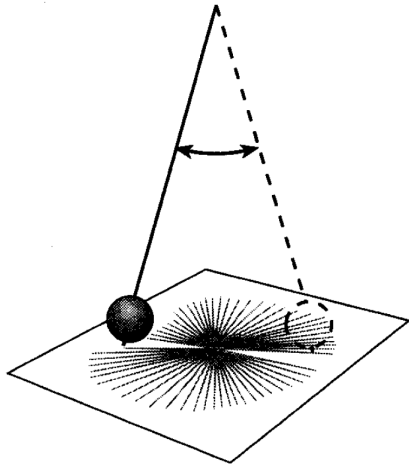
- 
221. The motion of a Foucault pendulum provides evidence of

- A the Sun's rotation
- B the Sun's revolution
- C Earth's rotation
- D Earth's revolution

- 
222. In New York State, how do the points of sunrise and sunset change during the course of 1 year?

- A They vary with each season in a cyclic manner.
  - B They move toward the north in the autumn months.
  - C They move toward the south in the spring months.
  - D They remain the same during the four seasons.
-

223. The diagram below shows a heavy mass moving back and forth in a straight-line direction. The apparent direction of movement changes over time.



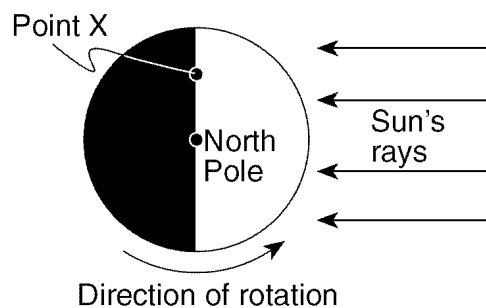
This device provides evidence that

- A Earth rotates
- B Earth's axis is tilted
- C Earth revolves
- D Earth has a magnetic pole

224. How does the position of *Polaris* appear to change as an observer travels due north from the Equator?

- A The angle of *Polaris* above the northern horizon decreases.
- B The angle of *Polaris* above the northern horizon increases.
- C *Polaris* appears to move westward.
- D *Polaris* appears to move eastward.

225. Base your answer to the following question on The diagram below represents the direction of Earth's rotation as it appears from above the North Pole. Point X is a location on Earth's surface.



The time at point X is closest to

- A 6 a.m.
- B 12 noon
- C 6 p.m.
- D 12 midnight

226. Which diagram best represents the tilt of Earth's axis that causes the Northern Hemisphere seasons shown? (Diagrams are not drawn to scale.)

