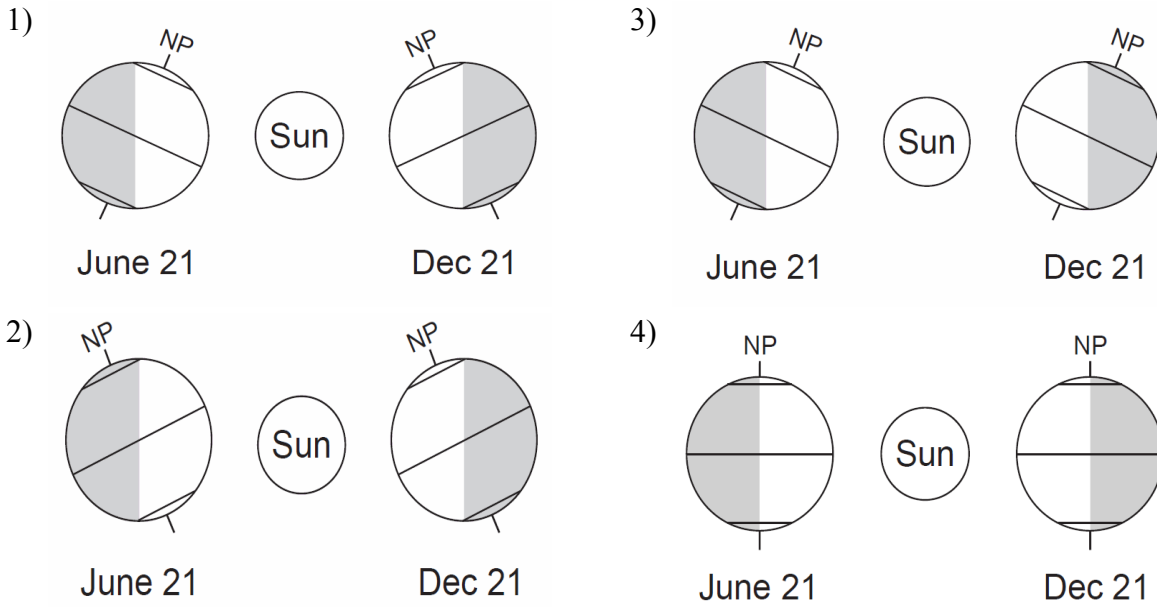
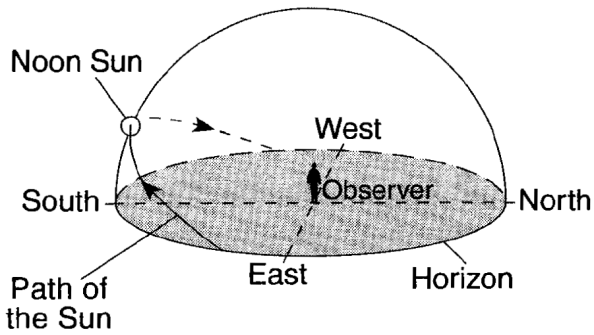


# The Sun's Path and Seasons

1. Which diagram best represents the regions of Earth in sunlight on June 21 and December 21? [NP indicates the North Pole and the shading represents Earth's night side. Diagrams are not drawn to scale.]



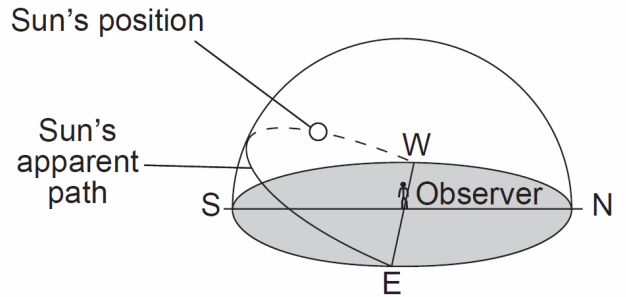
2. The model below shows the apparent path of the Sun as seen by an observer in New York State on the first day of one of the four seasons.



This apparent path of the Sun was observed on the first day of

- 1) spring
- 2) summer
- 3) fall
- 4) winter

3. The diagram below represents the apparent path of the Sun as seen by an observer at 65° N on March 21.

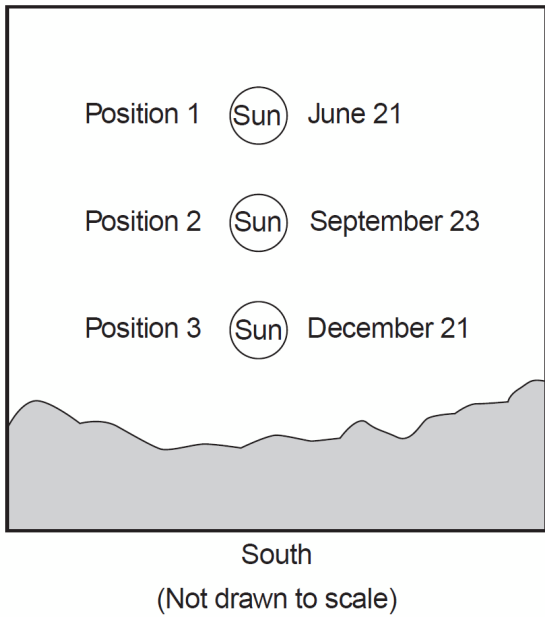


The Sun's position shown in the diagram was observed closest to which time of day?

- 1) 9 a.m.
- 2) 11 a.m.
- 3) 3 p.m.
- 4) 6 p.m.

## The Sun's Path and Seasons

4. Positions 1, 2, and 3 in the diagram below represent the noon Sun above the horizon on three different days during the year, as viewed from Binghamton, New York.



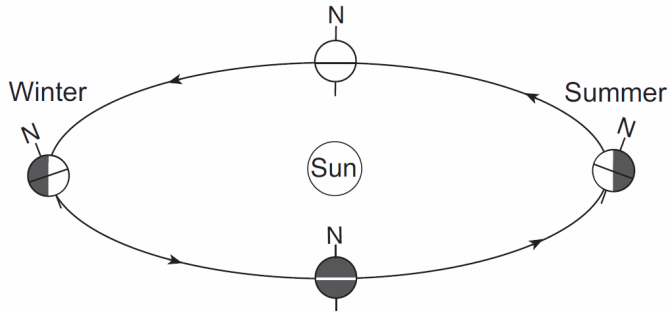
At which position was the noon Sun on January 21, as viewed from Binghamton?

- 1) above position 1
- 2) below position 3
- 3) between position 1 and position 2
- 4) between position 2 and position 3

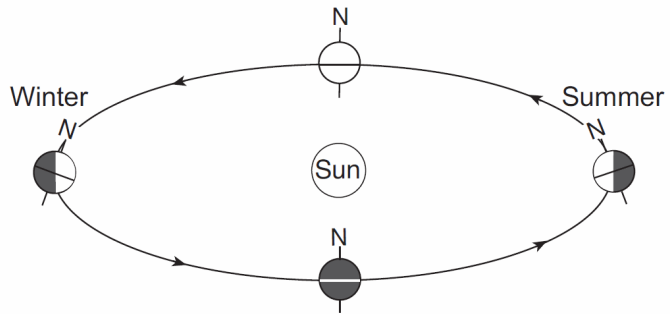
# The Sun's Path and Seasons

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

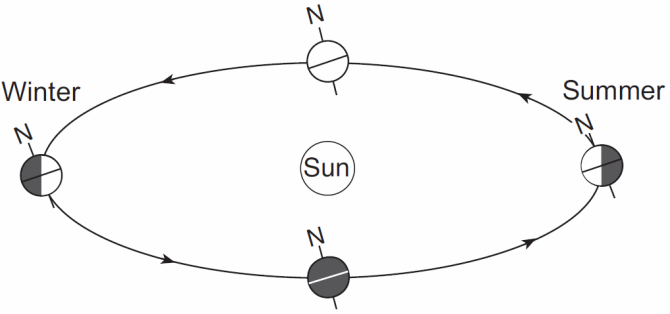
1)



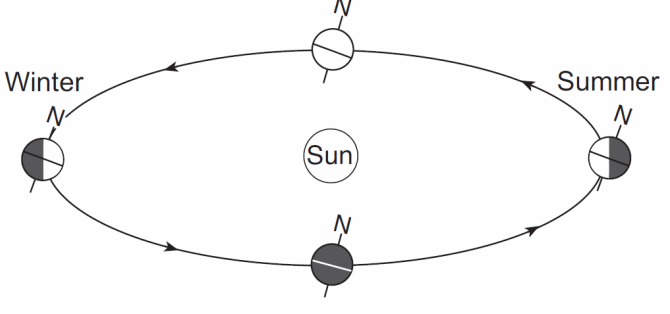
2)



3)

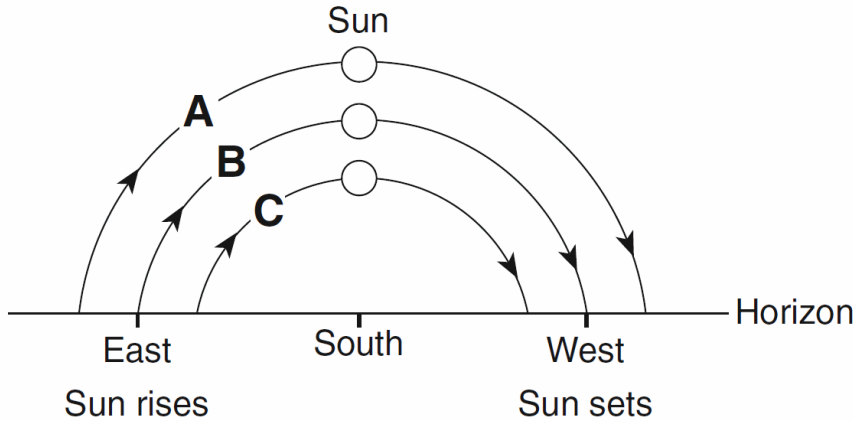


4)



## The Sun's Path and Seasons

6. 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?

1)

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

3)

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

2)

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

4)

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

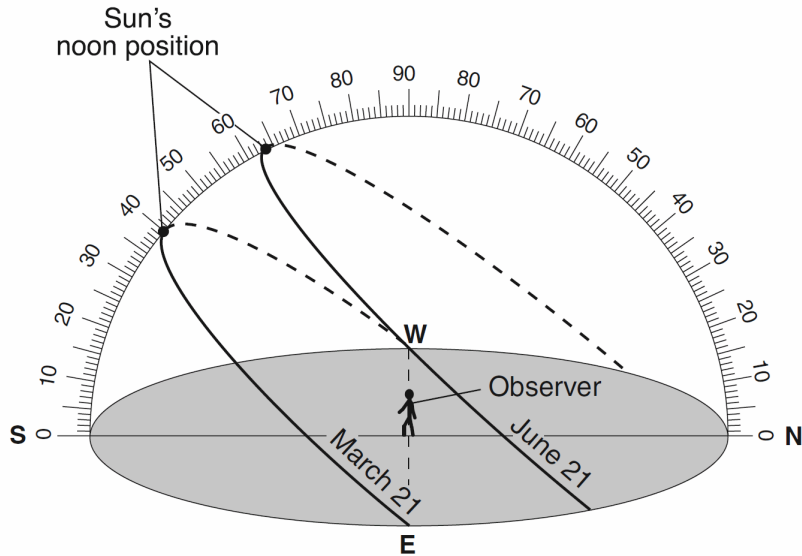
7. Evidence that Earth revolves around the Sun is provided by the

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

## The Sun's Path and Seasons

Base your answers to questions 8 and 9 on

diagram and data table below. The diagram represents the Sun's apparent paths as viewed by an observer located at  $50^\circ$  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.



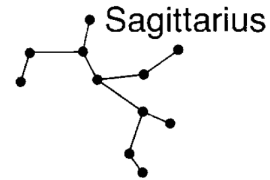
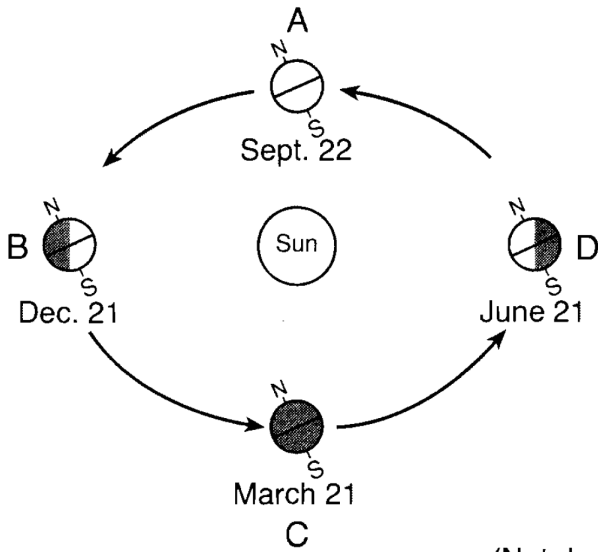
**Data Table**

Date	Sun's Maximum Altitude
June 21	$63.5^\circ$
March 21	$40^\circ$
December 21	

8. Which statement best compares the intensity and angle of insolation at noon on March 21 and June 21?
- 1) The intensity and angle of insolation are greatest on March 21.
  - 2) The intensity and angle of insolation are greatest on June 21.
  - 3) The intensity of insolation is greatest on June 21 and the angle of insolation is greatest on March 21.
  - 4) The intensity of insolation is greatest on March 21 and the angle of insolation is greatest on June 21.
9. Which value should be placed in the data table for the Sun's maximum altitude on December 21?
- 1)  $16.5^\circ$
  - 2)  $23.5^\circ$
  - 3)  $40^\circ$
  - 4)  $90^\circ$

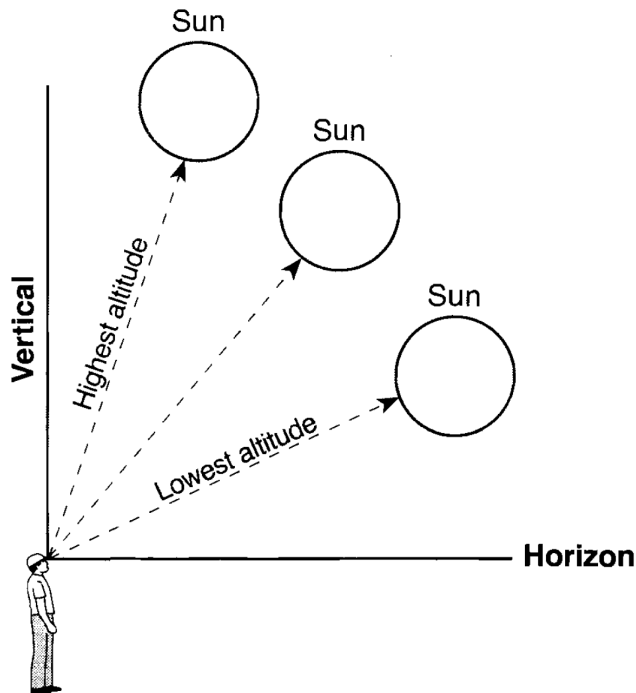
# The Sun's Path and Seasons

Base your answers to questions **10** and **11** 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.



(Not drawn to scale)

10. How many hours of daylight will an observer in New York State experience when Earth is at position *C*?
11. 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.

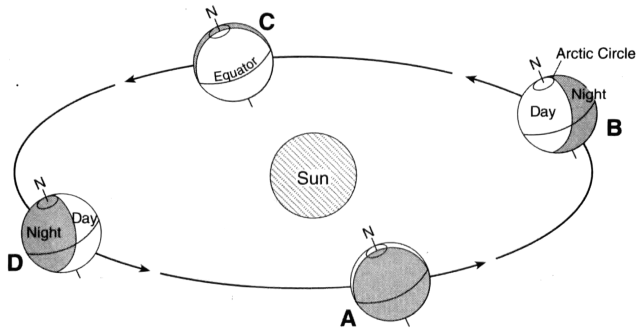


# The Sun's Path and Seasons

12. Which two factors cause the perpendicular rays of the Sun to move between  $23.5^\circ$  N and  $23.5^\circ$  S?

- 1) tilt of Earth's axis and Earth's revolution
- 2) tilt of Earth's axis and Earth's rotation
- 3) eccentricity of Earth's orbit and Earth's revolution
- 4) eccentricity of Earth's orbit and Earth's rotation

13. 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.



(Not drawn to scale)

Which location represents March 21?

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

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

1)

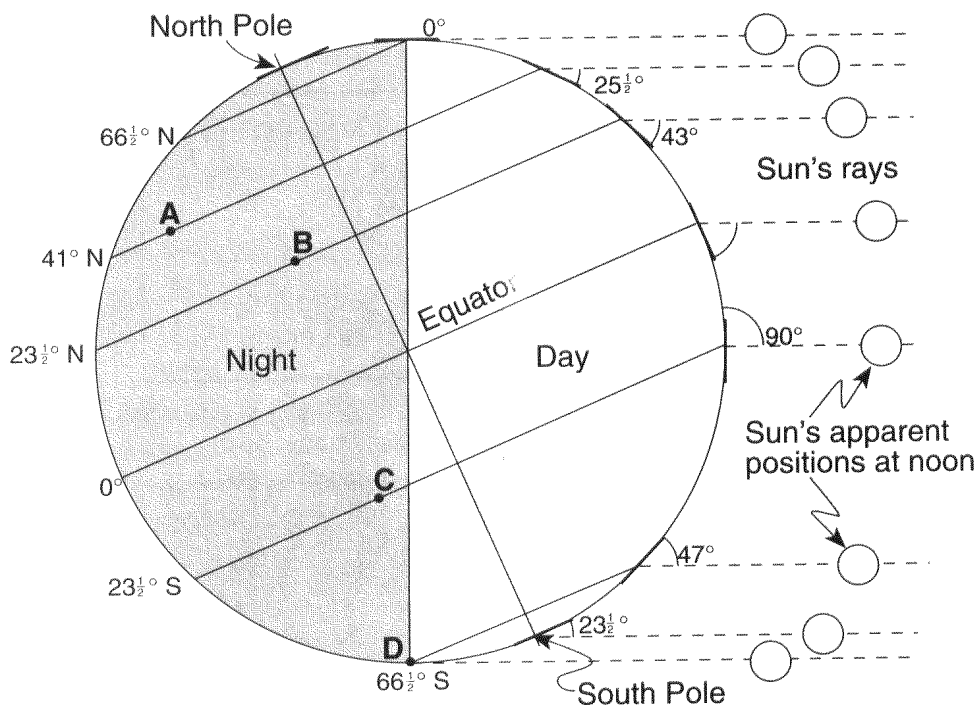
3)

2)

4)

# The Sun's Path and Seasons

Base your answers to questions 15 and 16 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)

15. Which season will begin at  $41^\circ$  N latitude, three months after the date represented by this diagram?

- 1) summer      2) fall      3) winter      4) spring

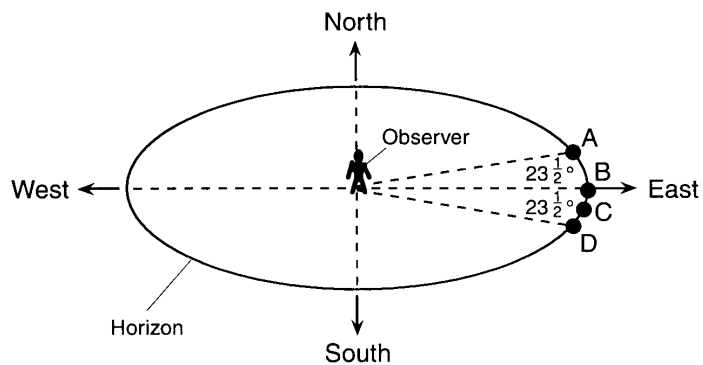
16. Which lettered location will experience the *shortest* period of daylight during one Earth rotation on this day?

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

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

- 1) Earth's axis is tilted  
 2) Earth's distance from the Sun changes  
 3) the Sun revolves  
 4) the Sun rotates

18. 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.



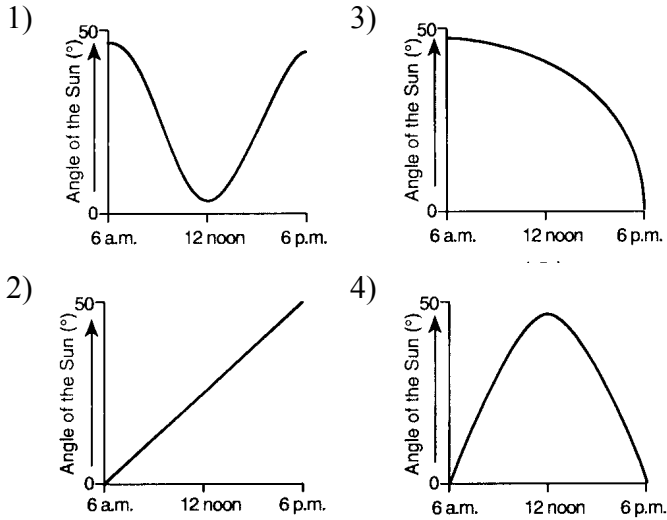
At which position would sunrise occur on June 21?

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



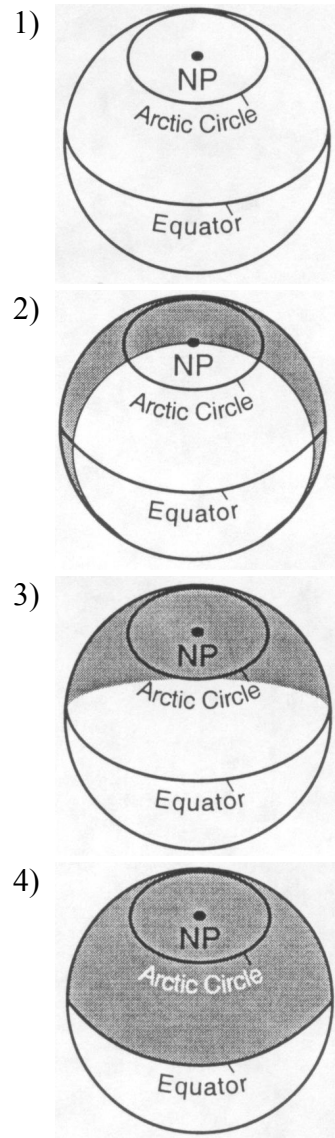
# The Sun's Path and Seasons

19. 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?



20. 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?

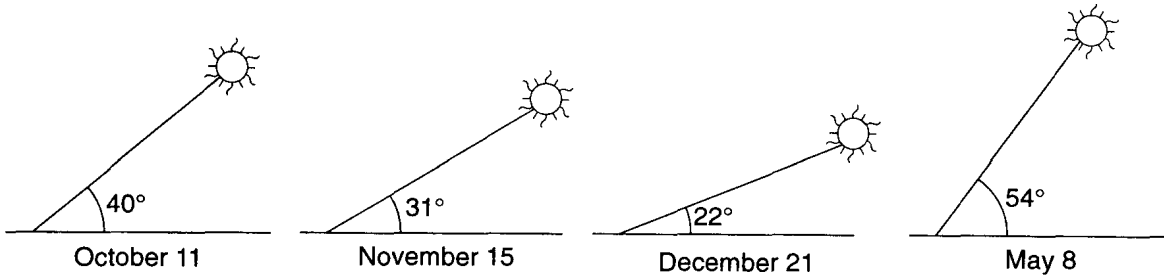
[Key:  = illuminated,  = shadow, NP = North Pole]



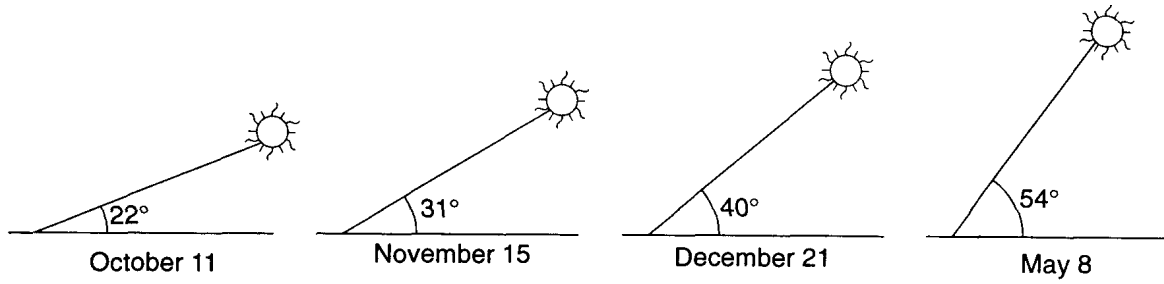
# The Sun's Path and Seasons

21. 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?

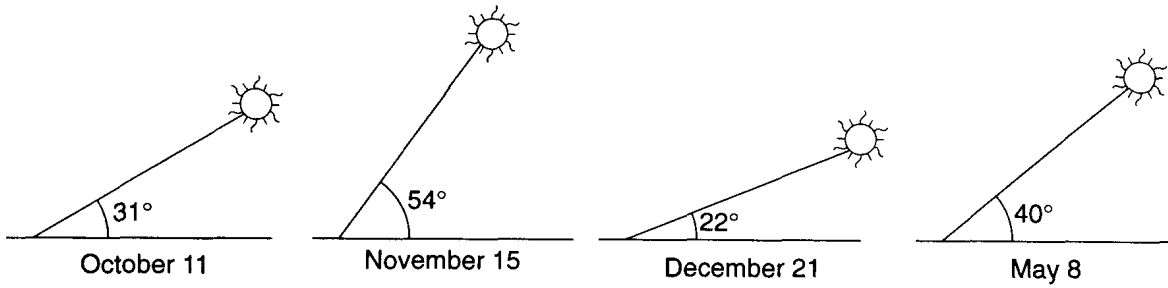
1)



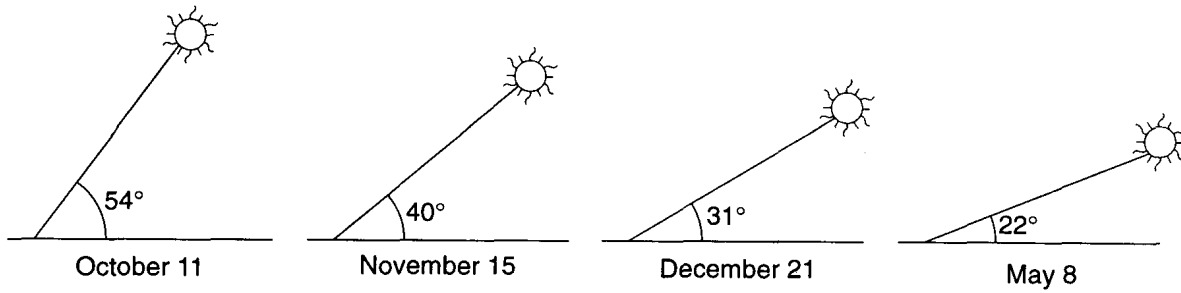
2)



3)

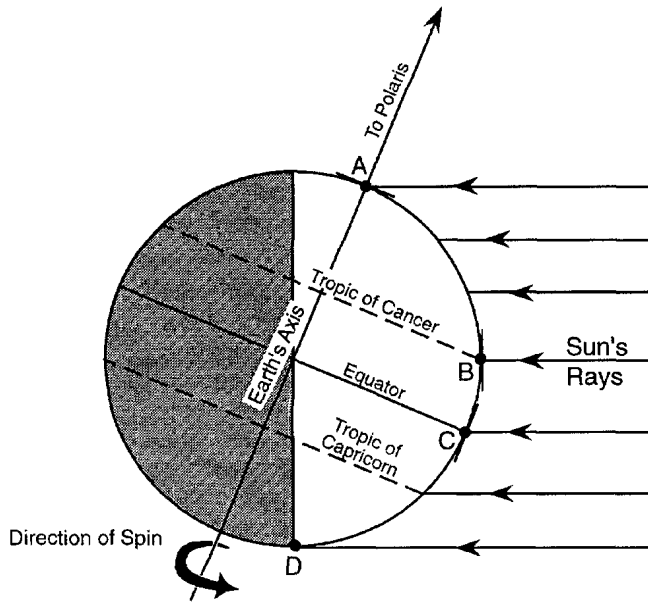


4)



## The Sun's Path and Seasons

Base your answers to questions 22 through 24 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.



22. During one complete rotation of the Earth on its axis, which position receives the *least* number of hours of daylight?
- 1) *A*    2) *B*    3) *C*    4) *D*
23. Which date is represented by the diagram?
- 1) March 21                      3) September 23  
2) June 21                        4) December 21
24. Which position is receiving the Sun's rays from directly overhead at solar noon?
- 1) *A*    2) *B*    3) *C*    4) *D*
- 
25. During the month of January, at which location in New York State is the Sun lowest in the sky at solar noon?
- 1) Massena                      3) Utica  
2) Niagara Falls                4) New York City