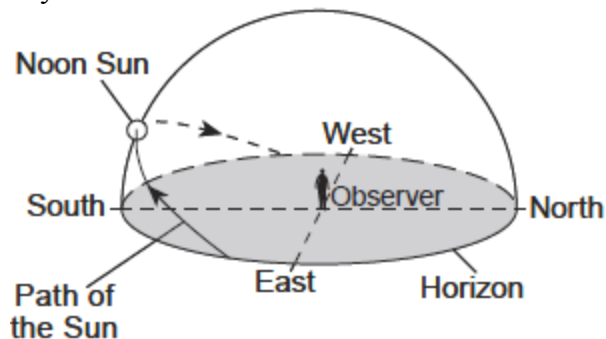


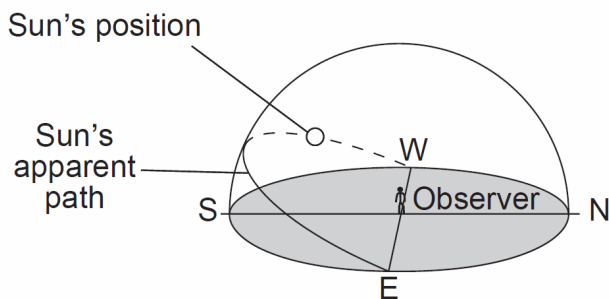
Seasons and Shadows

1. 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

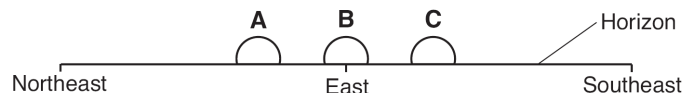
- 1) spring 2) summer
3) fall 4) winter
2. The diagram below represents the apparent path of the Sun as seen by an observer at 65° N on March 21.



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

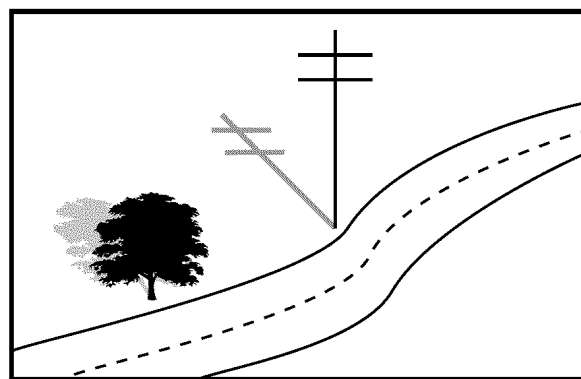
- 1) 9 a.m. 2) 11 a.m.
3) 3 p.m. 4) 6 p.m.
3. Which statement best describes the position of the Sun at sunrise and sunset as seen by an observer in New York State on June 21?
- 1) The Sun rises north of due east and sets north of due west.
2) The Sun rises south of due east and sets south of due west.
3) The Sun rises north of due east and sets south of due west.
4) The Sun rises south of due east and sets north of due west.

4. 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?

- 1) *A*—June 21
 B—March 21
 C—December 21
- 2) *A*—December 21
 B—March 21
 C—June 21
- 3) *A*—March 21
 B—June 21
 C—December 21
- 4) *A*—June 21
 B—December 21
 C—March 21
5. The diagram below shows the shadow cast by a telephone pole on March 21 at solar noon at a location in New York State.



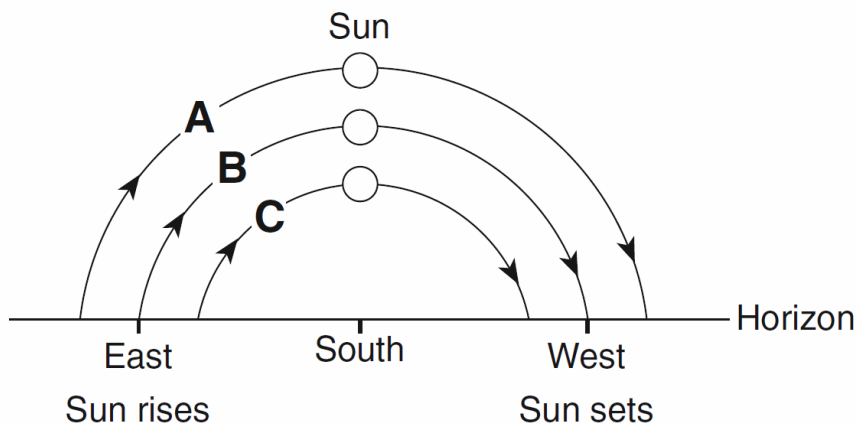
Shadow Cast on March 21

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

- 1) 2) 3) 4)

Seasons and Shadows

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

2)

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

3)

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

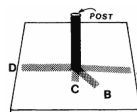
4)

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

7. What happens to the angle of the Sun on June 21 between solar noon and 6 p.m. in New York State?

- 1) It decreases steadily.
- 2) It increases steadily.
- 3) It remains the same.
- 4) It first increases and then decreases.

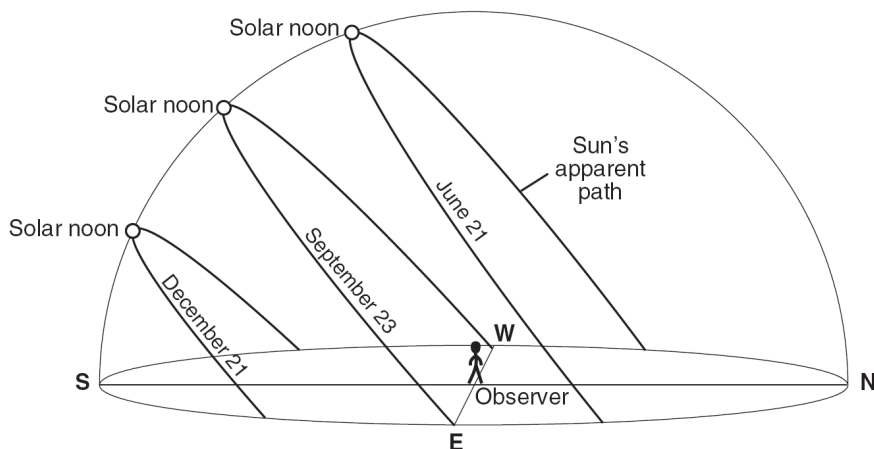
8. In the diagram below, a vertical post casts shadows *A*, *B*, *C*, and *D* at four different times during the day. Which shadow was cast when the Sun was at the greatest altitude?



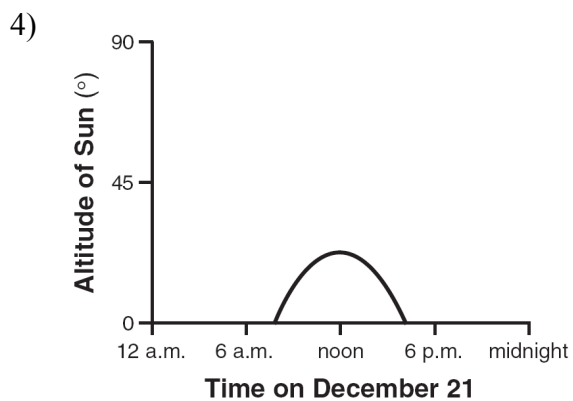
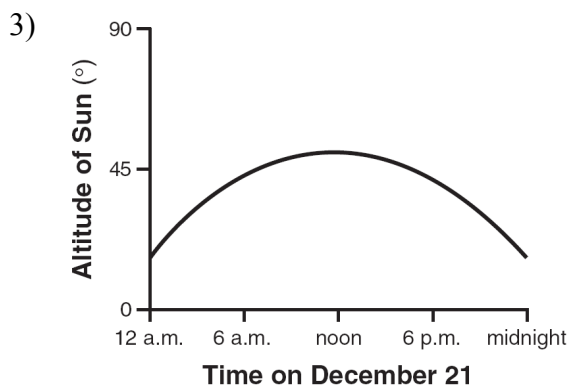
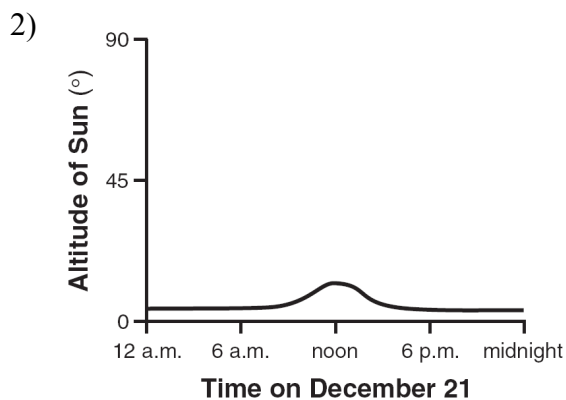
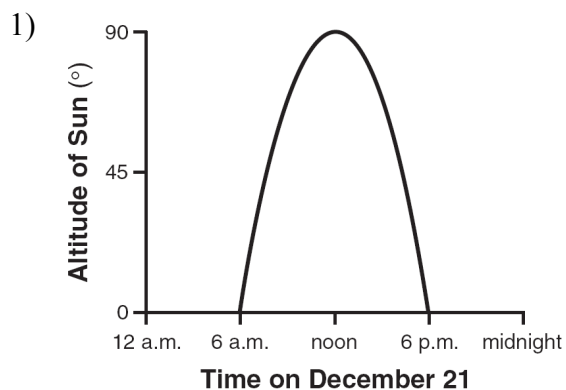
- 1) shadow *A*
- 2) shadow *B*
- 3) shadow *C*
- 4) shadow *D*

Seasons and Shadows

Base your answers to questions 9 and 10 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.



9. Which graph best shows the altitude of the Sun, as measured by the observer located at 42° N, at various times on December 21?

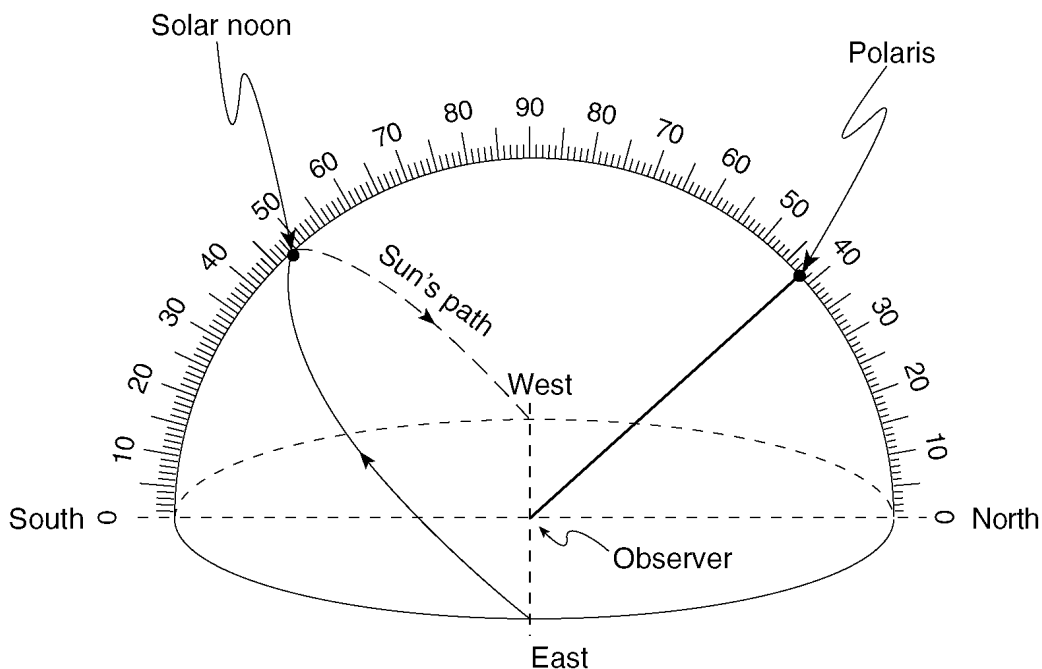


10 In which direction will sunrise occur on June 21?

- | | |
|----------------------|----------------------|
| 1) north of due west | 2) north of due east |
| 3) south of due west | 4) south of due east |

Seasons and Shadows

Base your answers to questions 11 and 12 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.



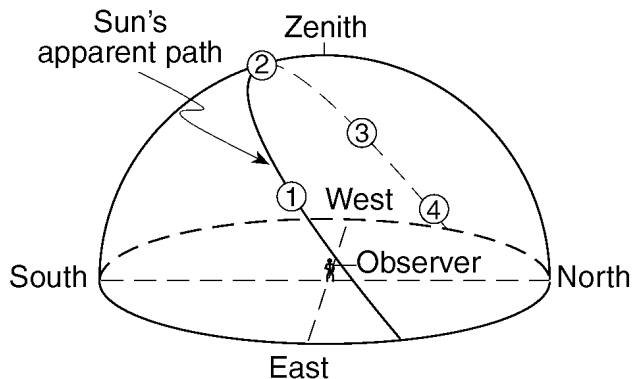
11 On which date could this observation of the Sun's apparent path have been made?

- 1) March 21 2) July 21 3) October 21 4) December 21

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

- 1) 23.5° 2) 42° 3) 48° 4) 90°

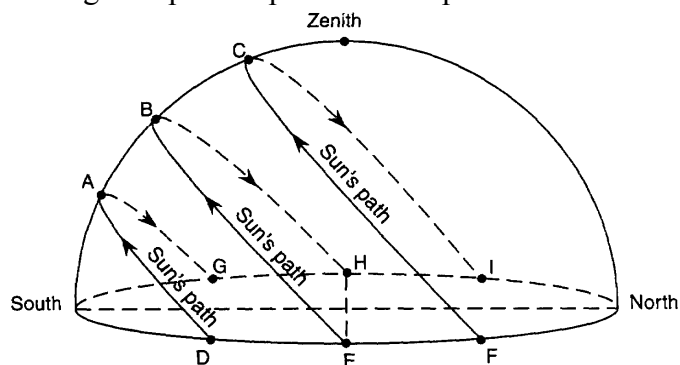
13. Base your answer to the following question on the diagram below, which shows numbered positions of the Sun at four different times along the Sun's apparent daily path, as seen by an observer in New Jersey. Numbers 1 through 4 represent apparent positions of the Sun.



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

- 1) 1 2) 2 3) 3 4) 4

14. 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.

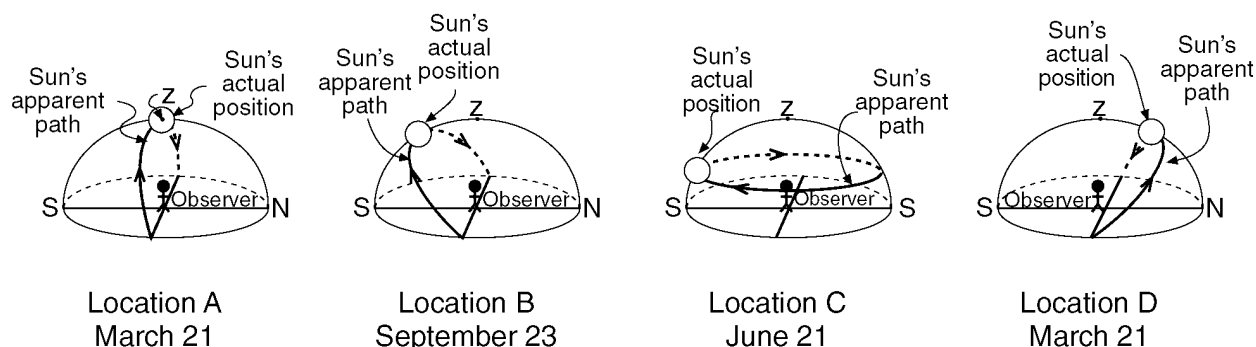


Which point represents the sunrise location on the first day of winter?

- 1) G 2) F 3) E 4) D

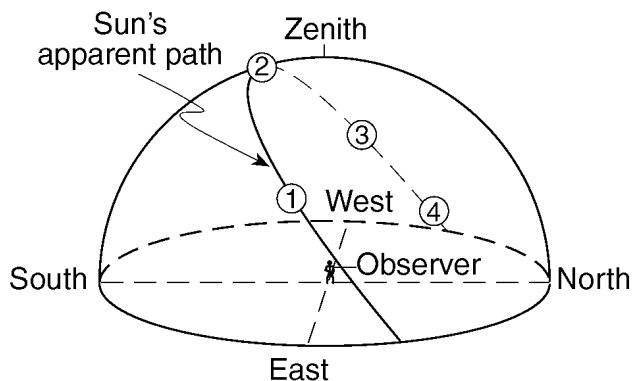
Seasons and Shadows

15. Base your answer to the following question 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.]



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

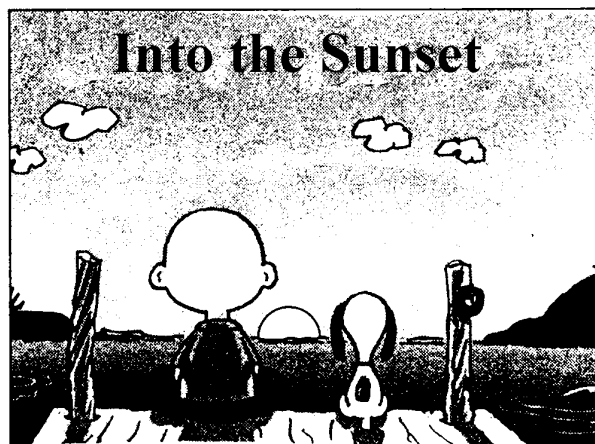
- | | |
|----------------------------|----------------------------|
| 1) increase, only | 2) decrease, only |
| 3) increase, then decrease | 4) decrease, then increase |
16. Base your answer to the following question on the diagram below, which shows numbered positions of the Sun at four different times along the Sun's apparent daily path, as seen by an observer in New York. Numbers 1 through 4 represent apparent positions of the Sun.



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

- | | |
|---------------|----------------|
| 1) March 21 | 2) June 21 |
| 3) October 21 | 4) December 21 |

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



Toward which general direction are the characters looking?

- 1) north 2) south 3) east 4) west

Seasons and Shadows

20. Which graph best shows the length of a shadow cast from sunrise to sunset by a flagpole in New York State?

