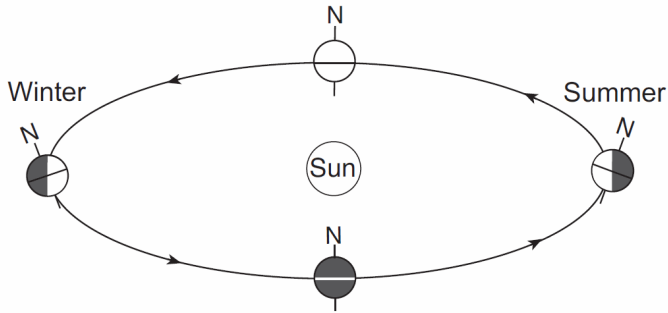


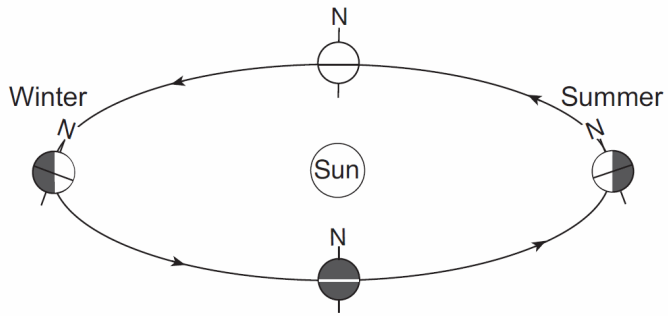


4. Which diagram best represents the tilt of Earth's axis that causes the Northern Hemisphere seasons shown?  
(Diagrams are not drawn to scale.)

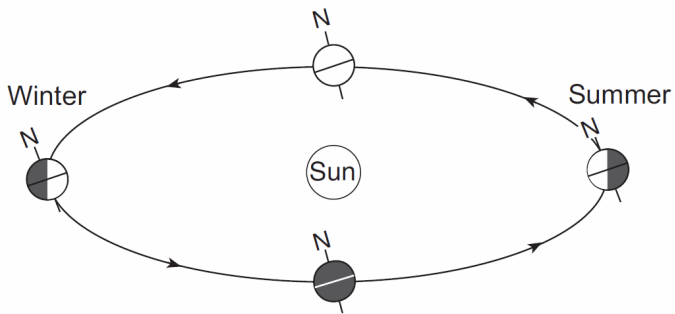
A)



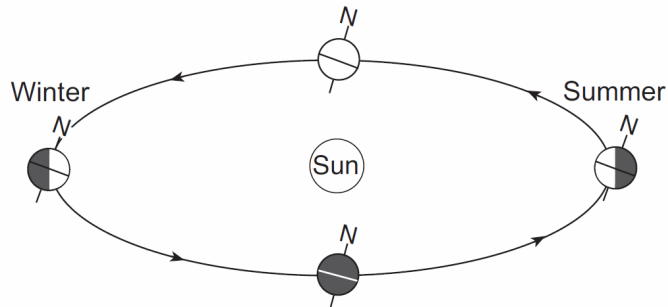
B)



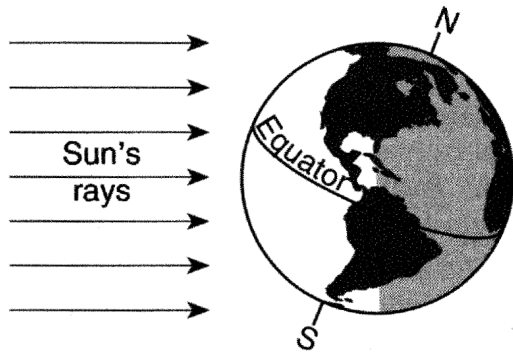
C)



D)



5. 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
6. The table below shows the times of ocean high tides and low tides on a certain date at a New York State location.

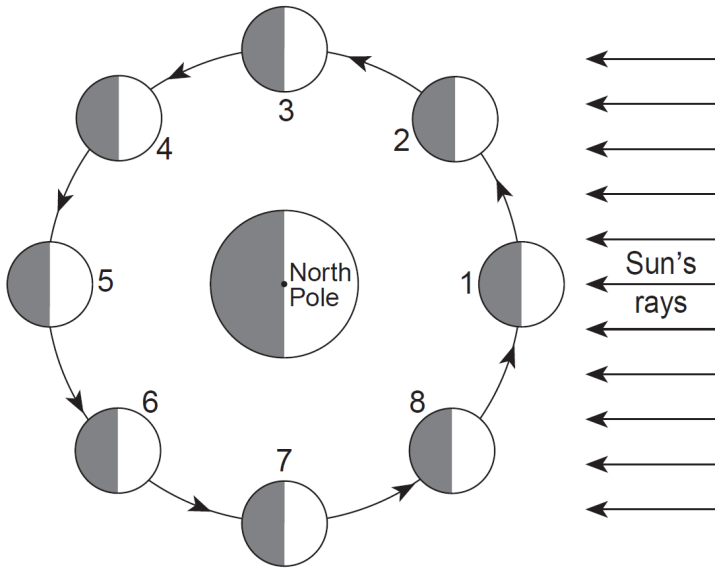
**Ocean Tides**

Type of Tide	Time
high	4:45 a.m.
low	10:58 a.m.
high	5:15 p.m.
low	11:22 p.m.

At approximately what time on the following day did the next high tide occur at this location?

- A) 4:40 a.m.                      B) 5:40 a.m.  
C) 4:40 p.m.                     D) 5:40 p.m.

Base your answers to questions 7 and 8 on the diagram below and on your knowledge of Earth science. The diagram represents eight numbered positions of the Moon in its orbit around Earth.



(Not drawn to scale)

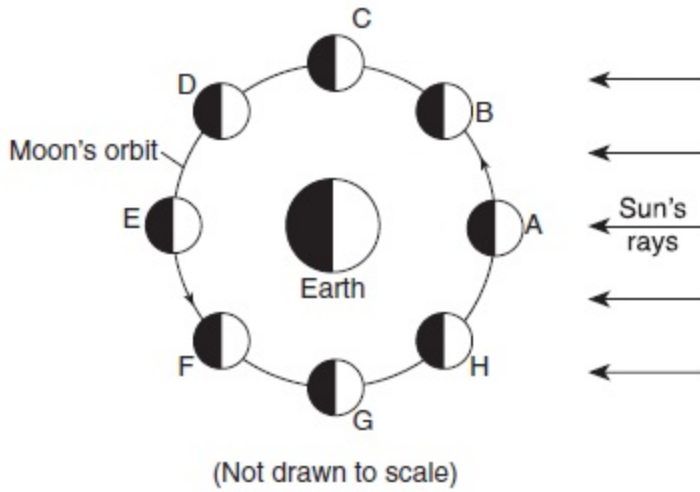
7. Which two motions cause the Moon to show a complete cycle of phases each month when viewed from New York State?

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

8. Which phase of the Moon will be observed in New York State when the Moon is at position 8?

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

Base your answers to questions 9 and 10 on the diagram below and on your knowledge of Earth science. The diagram represents the Moon in eight positions, *A* through *H*, in its orbit around Earth.



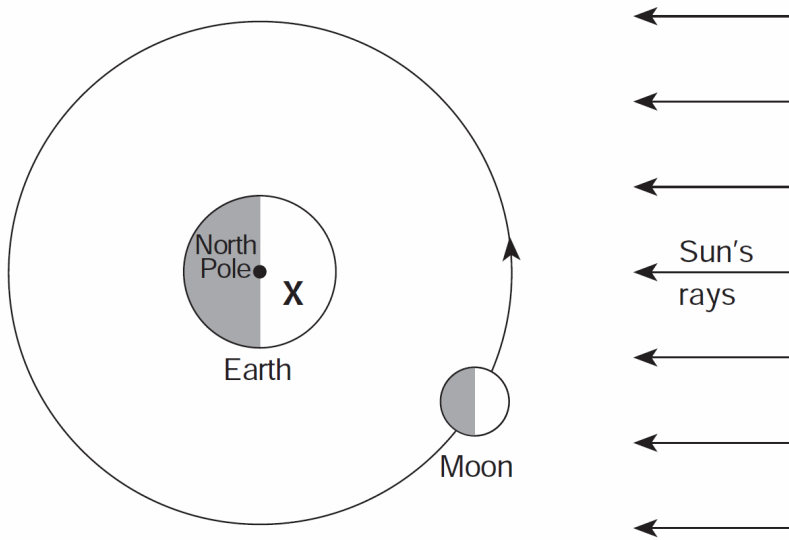
9. Which Moon phase is observed in New York State when the Moon is located at position *F*?

- |    |    |
|----|----|
| A) | B) |
| C) | D) |

10. When a solar eclipse is viewed from Earth, the Moon must be located at orbital position

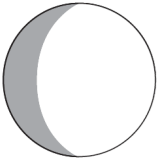
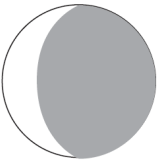
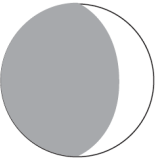
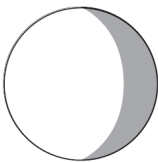
- A) *A*                      B) *E*                      C) *C*                      D) *G*

11. The diagram below shows the Moon at one position in its orbit around Earth. Letter X indicates the location of an observer in New York State.

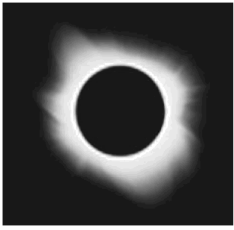


(Not drawn to scale)

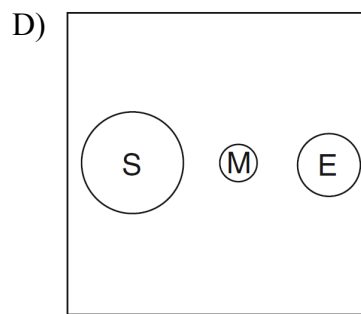
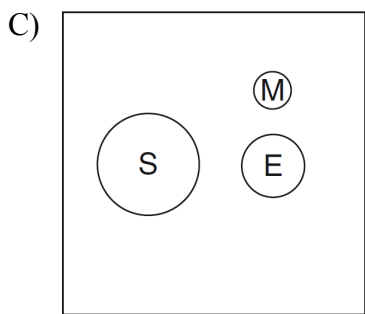
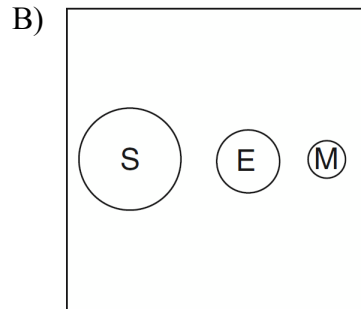
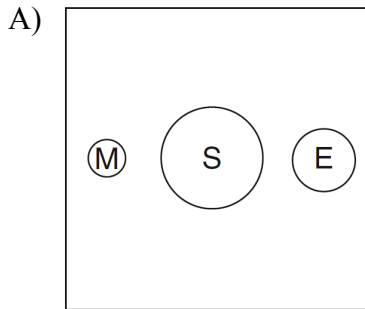
Which phase of the Moon will the observer see when the Moon is at the position shown in its orbit?

- A)  B)  C)  D) 

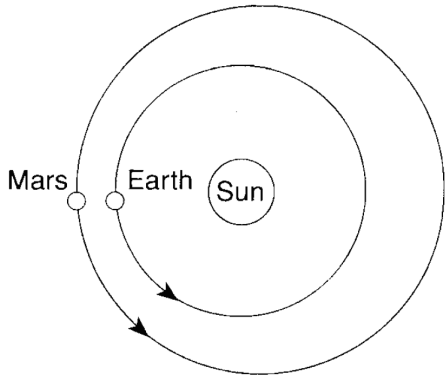
12. The diagram below represents a total solar eclipse as seen from Earth.



Which diagram correctly represents the relative positions of the Sun (*S*), Earth (*E*), and the Moon (*M*) in space during a total solar eclipse? [The diagrams are not drawn to scale.]

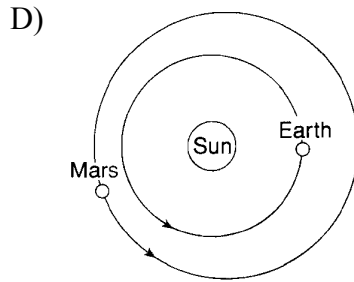
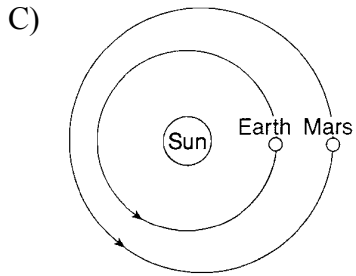
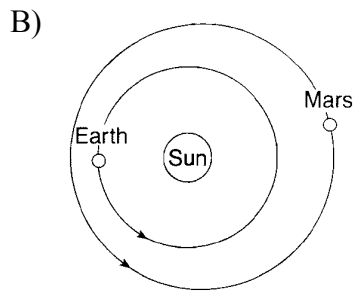
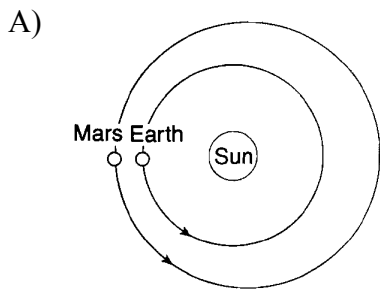


13. The diagram below shows the relative positions of Earth and Mars in their orbits on a particular date during the winter of 2007.



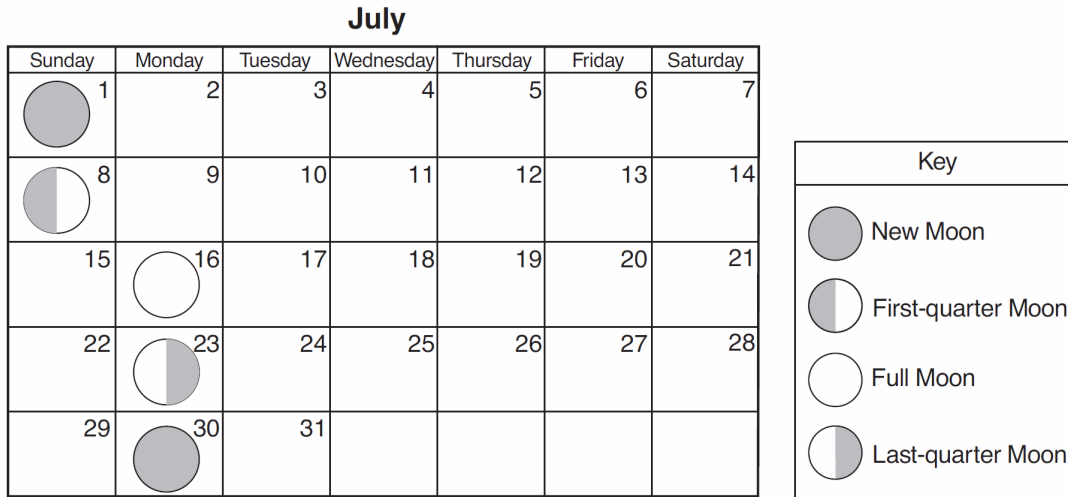
(Not drawn to scale)

Which diagram correctly shows the locations of Earth and Mars on the same date during the winter of 2008?

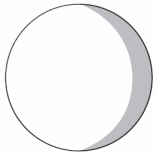




14. Base your answer to the following question on the calendar below, which shows the month of July of a recent year. The dates of major Moon phases, as seen in New York State, are shown.



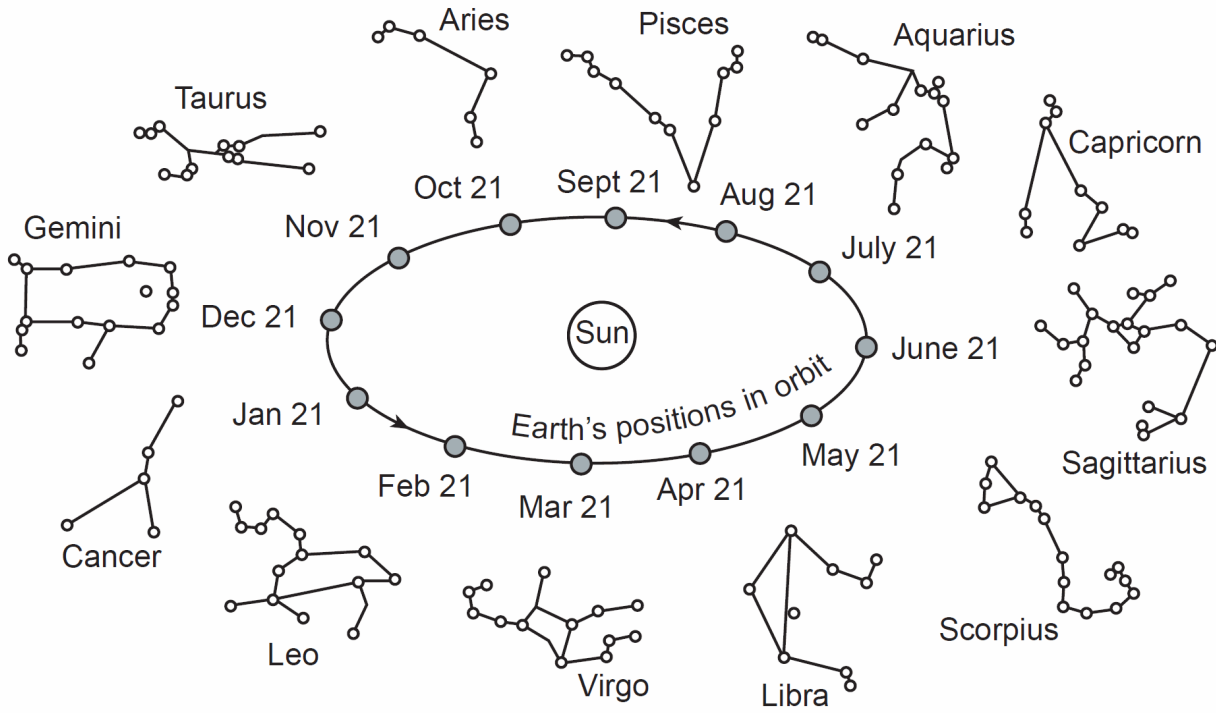
The diagram below represents the phase of the Moon observed from New York State one night during the month of July.



Why does the Moon's gravity have a greater effect on Earth's ocean tides than the Sun's gravity?

- A) The Sun is composed mostly of gases.
- B) The Sun's gravity influences more planets.
- C) The Moon has a greater mass.
- D) The Moon is much closer to Earth.

15. The diagram below represents positions of Earth in its orbit around the Sun and twelve constellations that can be seen in the midnight sky by an observer in New York State at different times of the year. The approximate locations of the constellations in relation to Earth's orbit are shown.



(Not drawn to scale)

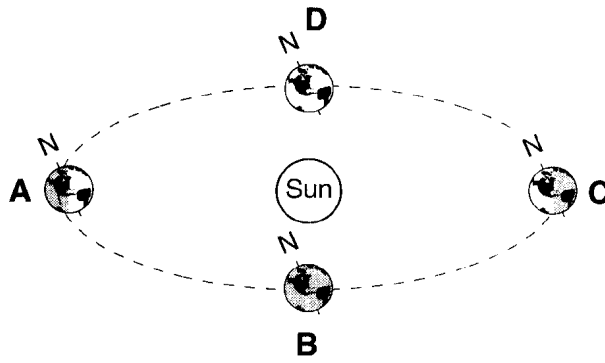
Which date is correctly paired with two constellations that can be seen in the sky at midnight?

- A) May 21: Scorpius and Taurus
- B) August 21: Libra and Virgo
- C) November 21: Gemini and Capricorn
- D) February 21: Leo and Cancer

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

- A) 60°
- B) 45°
- C) 3°
- D) 15°

17. Base your answer to the following question 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)

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

- 
18. 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

19. In the Northern Hemisphere, planetary winds are deflected to the right due to the

- A) Doppler effect
- B) Coriolis effect
- C) tilt of Earth's axis
- D) uneven heating of Earth's surface

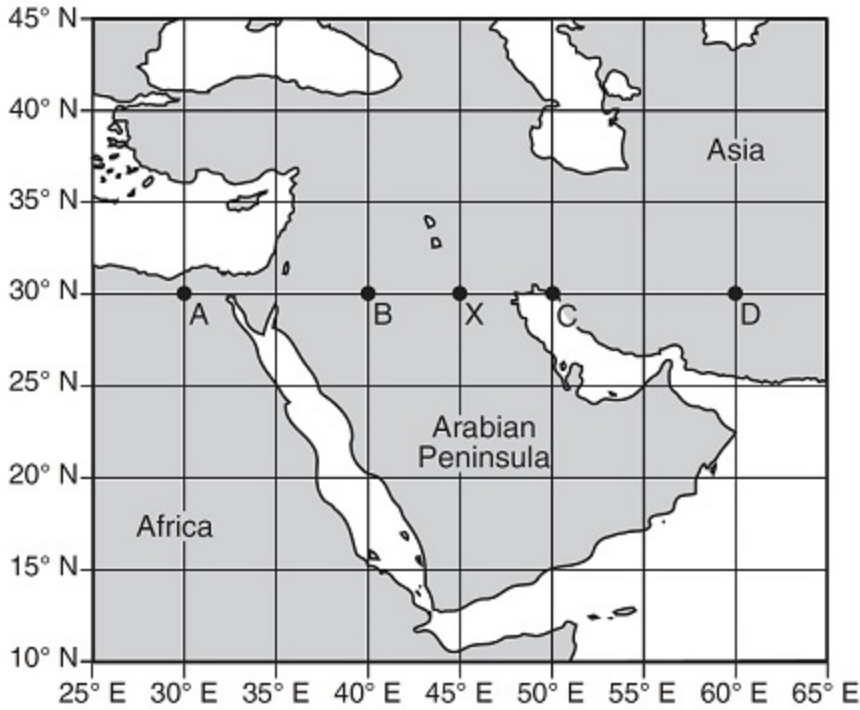
20. What causes many surface winds to deflect to the right in the Northern Hemisphere?

- 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

21. Which statement best describes Earth's approximate rates of rotation and revolution?

- A) Earth's rotation rate is  $15^\circ$ /hour and its revolution rate is  $1^\circ$ /day.
  - B) Earth's rotation rate is  $1^\circ$ /hour and its revolution rate is  $15^\circ$ /day.
  - C) Earth's rotation rate is  $24^\circ$ /hour and its revolution rate is  $360^\circ$ /day.
  - D) Earth's rotation rate is  $360^\circ$ /hour and its revolution rate is  $24^\circ$ /day.
-

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



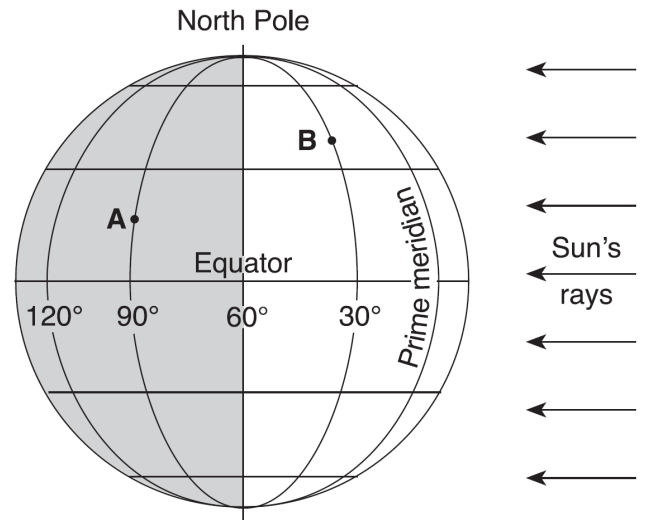
When it is 10:00 a.m. solar time at location *X*, at which location is 11:00 a.m. solar time being observed?

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

23. 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

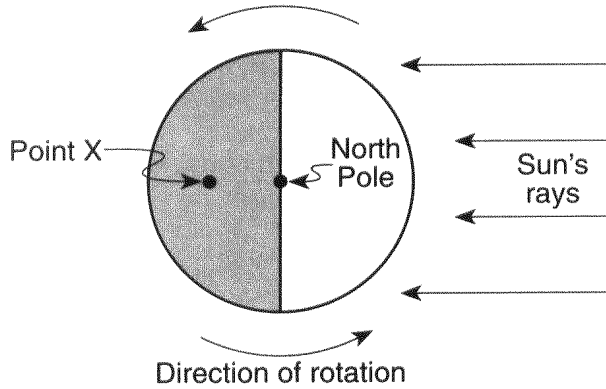
24. The diagram below shows the latitude and longitude lines on Earth. Points *A* and *B* are locations on Earth's surface.



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.

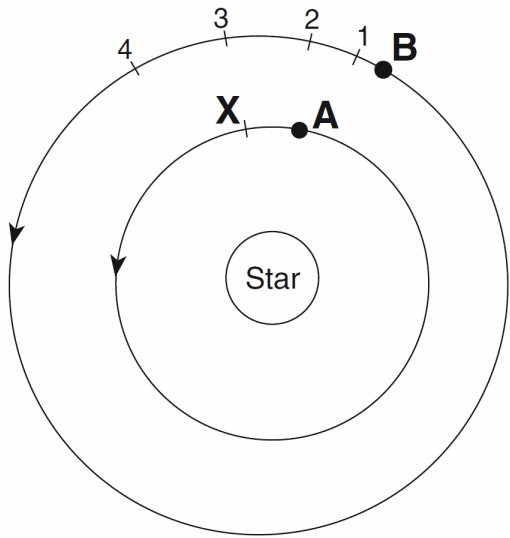
25. The diagram below represents the direction of Earth's rotation as it appears from above the North Pole. Point X is a location on Earth's surface.



The time at point X is closest to

- A) 9 a.m.                      B) 12 noon  
C) 9 p.m.                      D) 12 midnight
26. In the geocentric model (the Earth at the center of the universe), which motion would occur?
- A) The Earth would revolve around the Sun.  
B) The Earth would rotate on its axis.  
C) The Moon would revolve around the Sun.  
D) The Sun would revolve around the Earth.
27. Compared to the orbit of the Jovian planets, the orbit of Halley's comet is
- A) less elliptical, with a shorter distance between its foci  
B) less elliptical, with a greater distance between its foci  
C) more elliptical, with a shorter distance between its foci  
D) more elliptical, with a greater distance between its foci

28. Base your answer to the following question on the diagram below, which represents the current locations of two planets, *A* and *B*, orbiting a star. Letter *X* indicates a position in the orbit of planet *A*. Numbers 1 through 4 indicate positions in the orbit of planet *B*.

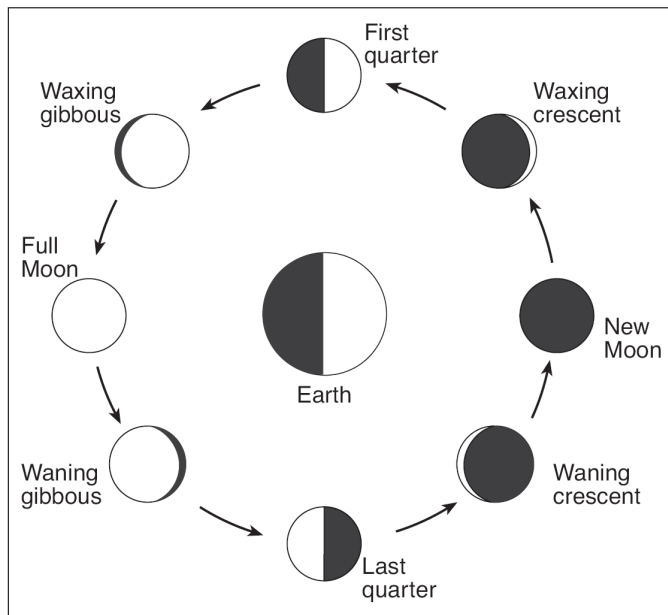


(Not drawn to scale)

If the diagram represents our solar system and planet *B* is Venus, which planet is represented by planet *A*?

- A) Mercury      B) Jupiter      C) Earth      D) Mars

Base your answers to questions 29 and 30 on the diagram below, which shows positions of the Moon in its orbit and phases of the Moon as viewed from New York State.



(Not drawn to scale)

29. Which statement best explains why the same side of the Moon is viewed from Earth as the Moon goes through its phases?

- A) The Moon does not rotate as it revolves around Earth.
- B) The Moon's period of rotation equals Earth's period of rotation.
- C) The Moon's period of rotation equals Earth's period of revolution around the Sun.
- D) The Moon's period of rotation equals the Moon's period of revolution around Earth.

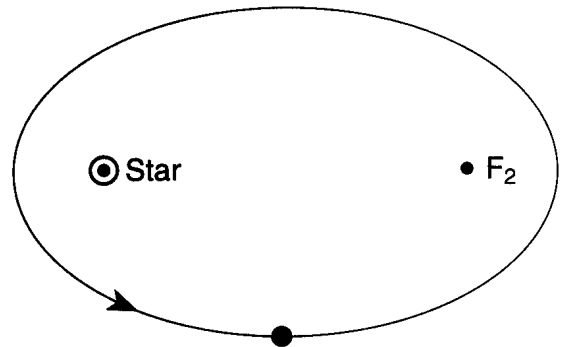
30. What is the eccentricity of the Moon's orbit?

- A) 0.017
- B) 0.055
- C) 0.386
- D) 0.723

31. Which planet has the *least* distance between the two foci of its elliptical orbit?

- A) Venus
- B) Earth
- C) Mars
- D) Jupiter

32. The diagram below shows the elliptical orbit of a planet revolving around a star. The star and  $F_2$  are the foci of this ellipse.



What is the approximate eccentricity of this ellipse?

- A) 0.22
- B) 0.47
- C) 0.68
- D) 1.47