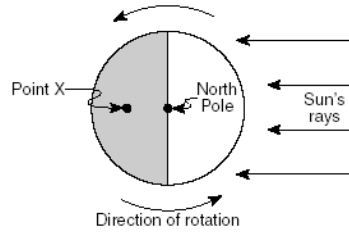The diagram represents the direction of Earth's rotation as it appears from above the North Pole. Point *X* is a location on Earth's surface.

1.  The time at point *X* is closest to
    (1) 6 a.m.                          (3) 6 p.m.
    (2) 12 noon                      **(4) 12 midnight**

2.  Which observation provides the best evidence that Earth revolves around the Sun?
    (1) Stars seen from Earth appear to circle *Polaris*.
    (2) Earth's planetary winds are deflected by the Coriolis effect.
    (3) The change from high ocean tide to low ocean tide is a repeating pattern.
    **(4) Different star constellations are seen from Earth at different times of the year.**

**Questions 3-4:**
The diagram to the right shows a planet in 8 different
positions as it revolves around a star.
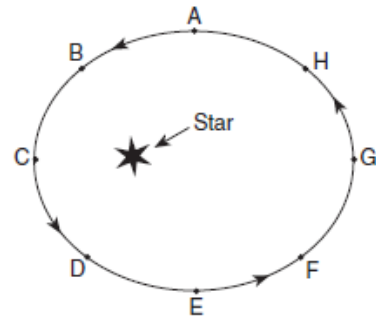
3.  At which position would the planet have the greatest orbital velocity?
    (1)  A                              **(3)  C**
    (2)  E                              (4)  G

4.  As the planet moves in its orbit from position C to position G,
    the apparent diameter of the star as viewed from the planet will
    (1)   increase                      **(3)   decrease**
    (2)   remain the same          (4)   increase, then decrease

5.  Day and night are caused by the Earth
    (1)   revolving at a rate of 15°/hr            **(3)   rotating at a rate of 15°/hr**
    (2)   revolving at a rate of 1°/day            (4)   rotating at a rate of 15°/day

6.  Sketch the phase of the Moon as it would be seen from Earth when the Moon is located at point F.

(NOT DRAWN TO SCALE)
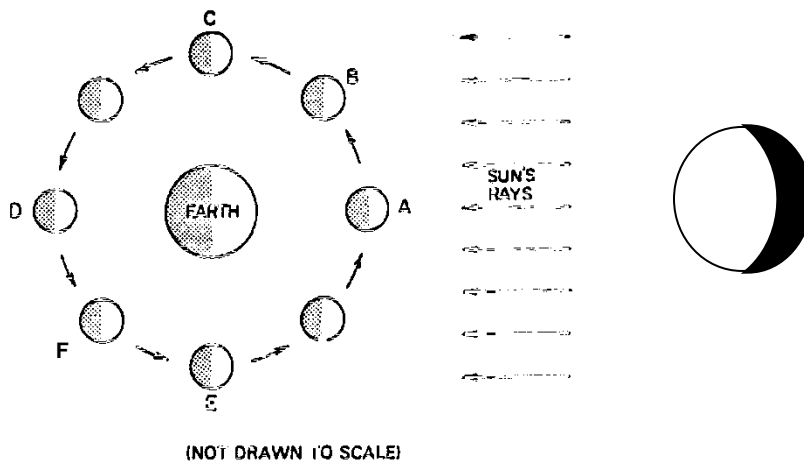
7.  On June 21st an observer in New York is observing her shadow at noon.  Which of the following is true of her shadow?
    (1)  her shadow is pointing south and is very short            **(3)  her shadow is pointing north and is very short**
    (2)  her shadow is pointing south and is very long            (4)  her shadow is pointing north and is very long

**Questions 8-9:**
The diagram to the right shows the Earth at a specific time of the year.
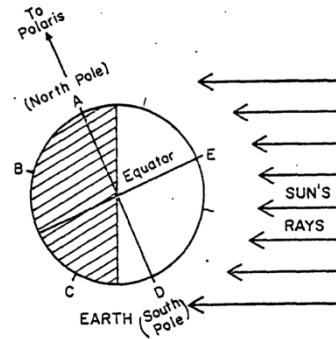
8. What season is it in New York?
    **(1)  winter**
    (2)  spring
    (3)  summer
    (4)  fall

9. Which location would have the most number of daylight hours?
    (1)   A          (2)  B                    (3)  C                    **(4)  D**
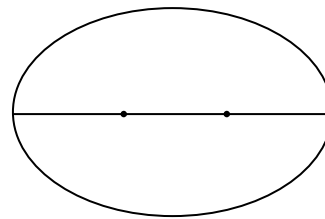
10. A Foucault pendulum appears to change its direction of swing over a period of several hours because of Earth's
    **(1) rotation**                              (3) tilted axis
    (2) revolution                            (4) gravity
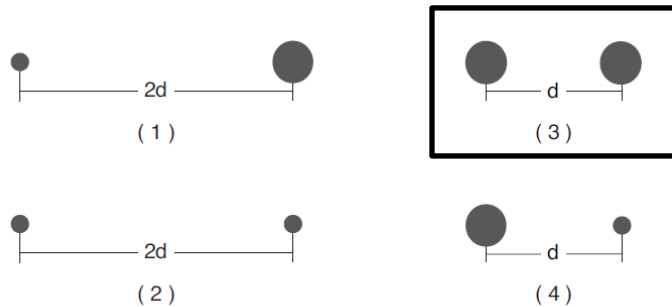
11. What is the eccentricity of the orbit shown to the right?
    Write formula, substitute data, round to nearest thousandths

    > **e = d/L**
    > **e= 1.4 / 4.3**
    > **e = .326**

12. Which diagram shows two stars that have the greatest gravitational force between them?

    2d
    ( 1 )

    d
    ( 3 )

    2d
    ( 2 )

    d
    ( 4 )

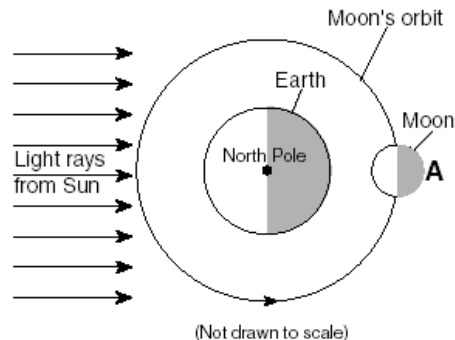13. How many hours of time exist between 15°N, 15°W and 30°N, 60°W?
    (1) 1                                      **(3) 3**
    (2) 2                                      (4) 4

14. Which of the following lists is true of events occurring
    in the diagram?

    1.   new moon, possible solar eclipse, spring tide
    **2.   full moon, possible lunar eclipse, spring tide**
    3.   new moon, possible solar eclipse, neap tide
    4.   full moon, possible lunar eclipse, neap tide

    Moon's orbit
    Earth
    Moon
    Light rays
    from Sun
    North Pole
    A
    (Not drawn to scale)

Use the celestial sphere as viewed from Syracuse, NY (43°N)
to answer **questions 15-16**.
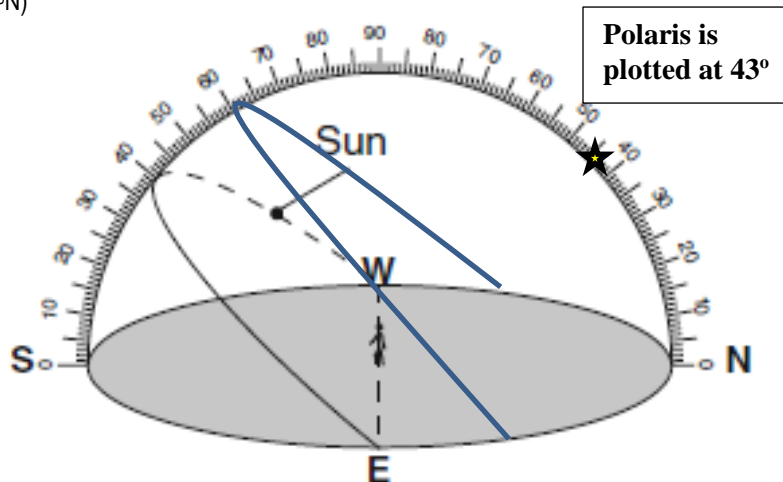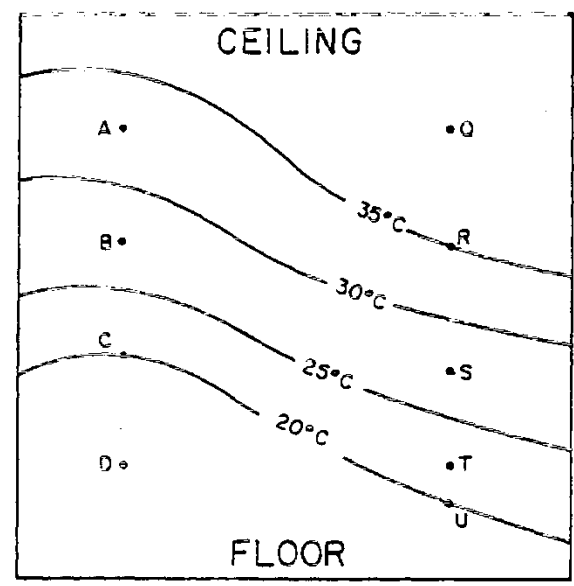
Polaris is
plotted at 43°

15. Which date of the year does the path of the
Sun in the diagram represent?
(1) June 21
**(2) September 23**
(3) October 31
(4) July 4

16. What time of day would the Sun be at the
position shown?
(1) 6:00 am          **(3) 3:00pm**
(2) 12:00 pm         (4) 9:00am

17. Sketch the June 21st path of the Sun as seen from this location.

18. Plot the location of Polaris on the celestial sphere as viewed from the location.

19. Calculate the temperature gradient between points C and R.
(Write formula, substitute data, solve with units, and round answer to the nearest tenths place).

CEILING

A •                              • Q

35°C
                                  R
B •

30°C

C

25°C              • S

20°C

D •              • T
                 U

FLOOR

0        I        2.
SCALE IN METERS

**gradient = change in field value**
                   **distance**

=      **35 – 20 °C**
        **3.1 m**

=   **4.8 °C/m**

20. Why would an observer on Earth see a complete cycle of phases on the Moon in approximately 1 month?
(1) The Moon rotates on its axis.              (3) The Earth rotates on its axis.
**(2) The Moon revolves around the Earth.**     (4) The Earth revolves around the Sun.

21. Between June 21st and December 21st the number of daylight hours experienced in New York
(1) increases, then decreases                 (3) continually increases
(2) decreases, then increases                 **(4) continually decreases**

22. Calculate the rate of change of atmospheric carbon dioxide from 1900 to 1980.
    Write the formula, substitute data and solve with units.
    Round your answer to the nearest hundredth.

**rate =**    **change in value**
         **change in time**

     **=**     **335 – 290 ppm**
            **80 years**

       **= .56 ppm/yr**

**Atmospheric CO$_2$ Levels**
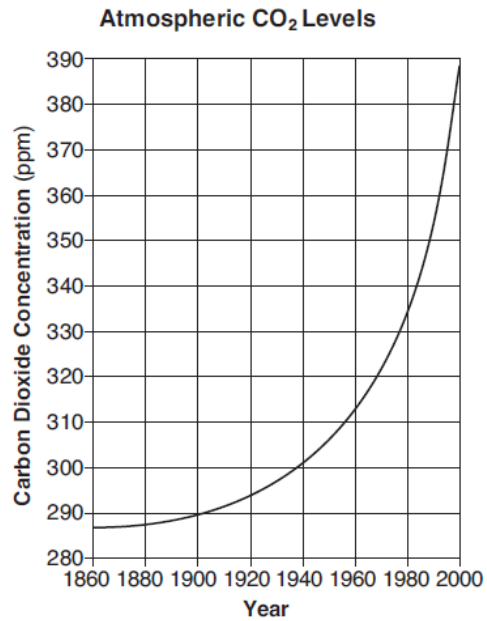


Use the diagram to the right to answer questions 23-25.

23. Which position represents summer in the Northern Hemisphere?      **C**

24. Which position represents the time when the North Pole gets 24 hours of darkness?    **A**

25. Which position represents the time when    **C**
    Earth is at aphelion?



(Not drawn to scale)
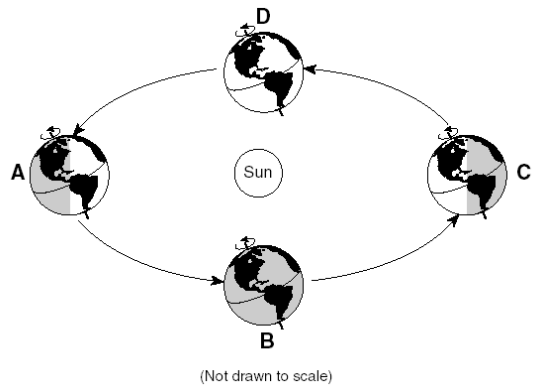
26. The diagram to the right represents a simple geocentric model.
    Which object is represented by X?
    **(1) Earth**
    (2) Sun
    (3) Moon
    (4) Polaris



( Not drawn to scale )
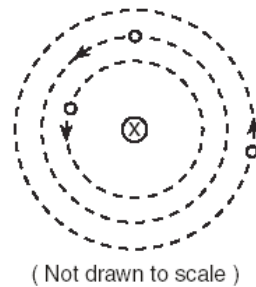
27. Compared to the terrestrial planets, the Jovian planets are
    (1) smaller and have lower densities          **(3) larger and have lower densities**
    (2) smaller and have greater densities       (4) larger and have greater densities

28. Compared with our Sun, the star *Procyon B* is
    **(1) smaller, hotter, and less luminous**       (3) larger, hotter, and less luminous
    (2) smaller, cooler, and more luminous      (4) larger, cooler, and more luminous