TRUE/FALSE

1. The equator is the only place on Earth where you can see the entire celestial sphere (day or night) over the course of 24 hours.

   ANS: T DIF: Easy REF: 2.1 OBJ: Factual
   TOP: II.C.i

2. Earth revolves around the Sun in the same direction Earth spins about its axis.

   ANS: T DIF: Easy REF: 2.1 OBJ: Factual
   TOP: III.B | I.B

3. If a star rises on the eastern horizon, it will set on the western horizon 6 hours later.

   ANS: F DIF: Medium REF: 2.1 OBJ: Applied
   TOP: II.C.i.b

4. The meridian is half of a great circle in the sky that passes through an observer's zenith and the Earth's poles.

   ANS: T DIF: Medium REF: 2.1 OBJ: Factual
   TOP: II.B.i

5. Constellations are arbitrary groupings of stars in the sky.

   ANS: T DIF: Easy REF: 2.2 OBJ: Factual
   TOP: III.E.i.a

6. The longest day of the year in the Northern Hemisphere occurs on the summer solstice.

   ANS: T DIF: Easy REF: 2.2 OBJ: Factual
   TOP: V.E.i

7. On the autumnal equinox, the lengths of both day and night are 12 hours.

   ANS: T DIF: Easy REF: 2.2 OBJ: Factual
   TOP: V.E.ii

8. The altitude of the Sun as it crosses the meridian changes during the year.

   ANS: T DIF: Medium REF: 2.2 OBJ: Factual
   TOP: V.C

9. A person who lives at the equator will see the Sun directly overhead at noon every day of the year.

   ANS: F DIF: Medium REF: 2.2 OBJ: Applied
   TOP: V.C

10. The seasons on Earth are caused by the change in distance between the Sun and Earth.

    ANS: F DIF: Medium REF: 2.2 OBJ: Factual
    TOP: V.B

11. The fact that we always see the same side of the Moon indicates that the Moon does not rotate about an axis.

ANS: F DIF: Medium REF: 2.3 OBJ: Conceptual
TOP: VI.B.i

12. A new Moon will always be in the eastern sky at sunrise.

ANS: T DIF: Medium REF: 2.3 OBJ: Applied
TOP: VII.A

13. When a solar eclipse occurs, the Sun lies between the Earth and Moon.

ANS: F DIF: Easy REF: 2.4 OBJ: Conceptual
TOP: VIII.A.i

14. When a lunar eclipse occurs, on average more people will witness it as a partial eclipse than as a total eclipse.

ANS: T DIF: Medium REF: 2.4 OBJ: Factual
TOP: VIII.A.ii

15. Johannes Kepler obtained accurate data on the positions of the planets in the sky over time, which Galileo used to prove that planets revolved around the Sun.

ANS: F DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.A

16. Planets orbit the Sun on circular orbits.

ANS: F DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.C.i

17. A planet travels fastest when it is closest to the Sun.

ANS: T DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.C.ii

18. As we move farther from the Sun, the circumferences of planetary orbits are larger and the speeds at which planets travel increase.

ANS: F DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.C.iii

19. Planets with circular orbits travel at the same speed at all points in their orbits, whereas planets with elliptical orbits change their speeds at different points in their orbits.

ANS: T DIF: Medium REF: 2.5 OBJ: Factual
TOP: IX.C.ii

20. Even though they move at faster average speeds, the outer planets in the Solar System have longer periods than the inner planets because they are so far from the Sun that their orbits are enormous.

ANS: F DIF: Medium REF: 2.5 OBJ: Applied
TOP: IX.C.iii

21. Johannes Kepler found that a planet's period was inversely proportional to the cube of its semimajor axis.

ANS: F DIF: Medium REF: 2.5 OBJ: Conceptual
TOP: IX.C.iii

22. Kepler's third law holds true mathematically only if the period is expressed in years and the semimajor axis is expressed in AU.

ANS: F DIF: Medium REF: Working It Out 2.2
OBJ: Applied TOP: IX.C.iii

MULTIPLE CHOICE

1. The direction directly overhead of an observer defines his/her:
   a. meridian
   b. celestial pole
   c. circumpolar plane
   d. zenith

ANS: D DIF: Easy REF: 2.1 OBJ: Factual
TOP: II.B.ii

2. No matter where you are on Earth, stars appear to rotate about a point called the:
   a. zenith
   b. celestial pole
   c. meridian
   d. equinox

ANS: B DIF: Easy REF: 2.1 OBJ: Factual
TOP: II.A.i

3. If the star Polaris has an altitude of 35° then we know that:
   a. our longitude is +55°
   b. our latitude is +55°
   c. our longitude is +35°
   d. our latitude is +35°

ANS: D DIF: Medium REF: 2.1 OBJ: Applied
TOP: II.C.i.c

4. At a latitude of +50°, how far above the horizon is the north celestial pole?
   a. 0°
   b. 40°
   c. 50°
   d. 90°

ANS: C DIF: Medium REF: 2.1 OBJ: Applied
TOP: II.C.i.c

5. The meridian is defined as a great circle on the sky on which lie the:
   a. celestial equator and vernal equinox
   b. north and south celestial poles
   c. zenith and the north and south celestial poles
   d. zenith and east and west directions

ANS: C DIF: Medium REF: 2.1 OBJ: Factual TOP: II.B.i

6. At what latitude is the north celestial pole located at your zenith?
   a. 0°
   b. +30°
   c. +60°
   d. +90°
   e. This occurs at every latitude.

   ANS: D DIF: Medium REF: 2.1 OBJ: Applied
   TOP: II.C.i.c

7. At what latitude is the north celestial pole at your horizon?
   a. 0°
   b. +30°
   c. +60°
   d. +90°
   e. This can never happen.

   ANS: A DIF: Medium REF: 2.1 OBJ: Applied
   TOP: II.C.i.c

8. The apparent path of the Sun across the celestial sphere during a year is called the:
   a. prime meridian
   b. ecliptic plane
   c. circumpolar plane
   d. celestial equator

   ANS: B DIF: Easy REF: 2.2 OBJ: Factual
   TOP: III.D

9. The ecliptic plane is defined by the motion of __________ in the sky.
   a. the Moon
   b. the Sun
   c. Polaris
   d. the stars

   ANS: B DIF: Easy REF: 2.2 OBJ: Factual
   TOP: III.D

10. How far away on average is the Earth from the Sun?
    a. 8.3 million kilometers
    b. 45 million kilometers
    c. 93 million kilometers
    d. 150 million kilometers

    ANS: D DIF: Easy REF: 2.2 OBJ: Factual
    TOP: III.A

11. If you go out at exactly 9 P.M. each evening over the course of one month, the position of a given star will move westward by tens of degrees. What causes this motion?
    a. The Earth's rotation on its axis
    b. The revolution of the Earth around the Sun
    c. The revolution of the Moon around the Earth
    d. The revolution of the Sun around the Earth

    ANS: B DIF: Easy REF: 2.2 OBJ: Applied
    TOP: III.E

12. The shortest day of the year for a person living in the NORTHERN Hemisphere is the:
    a. summer solstice
    b. vernal equinox
    c. winter solstice
    d. autumnal equinox

    ANS: C DIF: Easy REF: 2.2 OBJ: Applied
    TOP: V.E.i

13. On which day of the year does the Sun reach its northernmost point in the sky?
    a. Vernal equinox
    b. Summer solstice
    c. Autumnal equinox
    d. Winter solstice

    ANS: B DIF: Easy REF: 2.2 OBJ: Factual
    TOP: V.E.i

14. When the Northern Hemisphere experiences summer, the Southern Hemisphere experiences:
    a. spring
    b. summer
    c. fall
    d. winter

    ANS: D DIF: Easy REF: 2.2 OBJ: Factual
    TOP: V.C

15. The Earth's rotational axis precesses in space and completes one revolution every:
    a. 200 years
    b. 1,800 years
    c. 26,000 years
    d. 51,000 years

    ANS: C DIF: Easy REF: 2.2 OBJ: Factual
    TOP: V.G.i

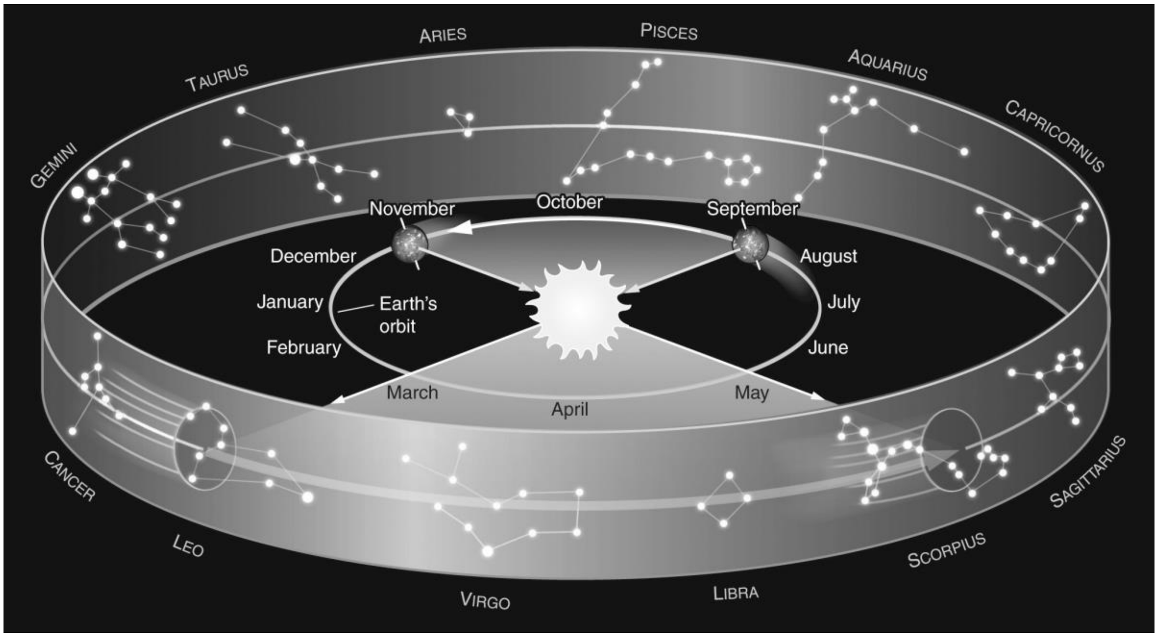
16. Leap years occur because:
    a. the Earth's orbital period around the Sun is decreasing
    b. the Earth's orbital period is 365.24 days
    c. the Gregorian calendar contains only 11 months
    d. the Earth speeds up in its orbit when it comes closest to the Sun

    ANS: B DIF: Easy REF: 2.2 OBJ: Conceptual
    TOP: V.F.ii

17. If the Earth's axis were tilted by 5° relative to the direction perpendicular to its orbital plane around the Sun, which would be TRUE?
    a. The seasons would remain the same.
    b. Summers would be warmer.
    c. Winters would last longer.
    d. Winters would be warmer.

    ANS: D DIF: Medium REF: 2.2 OBJ: Factual
    TOP: V.D

18. Assume you are observing the night sky from a typical city in the United States at a latitude of +40°. Use the figure below to determine which constellation of the zodiac would be nearest the meridian at midnight in March.



a. Scorpius
b. Gemini
c. Aquarius
d. Leo

ANS: D DIF: Medium REF: 2.2 OBJ: Applied
TOP: III.E.i

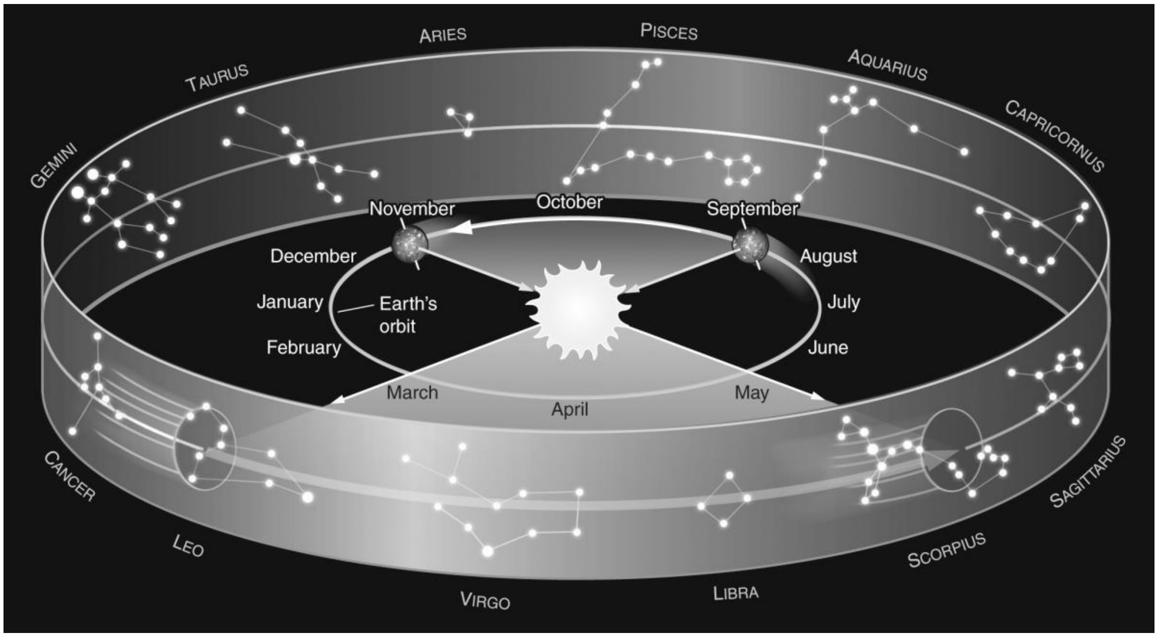
19. We experience seasons because:
a. the Earth's equator is tilted relative to the plane of the solar system
b. the Earth is closer to the Sun in summer and farther from the Sun in the winter
c. the length of the day is longer in the summer and shorter in the winter
d. the Earth moves with a slower speed in its orbit during summer and faster during winter

ANS: A DIF: Medium REF: 2.2 OBJ: Applied
TOP: V.D

20. If you went out tonight and looked at the sky at midnight, at what time would you have to observe 6 months from now in order to find the stars in exactly the same position in the sky? Assume that you could see the stars at any time, day or night.
a. 6 A.M.
b. Noon
c. 6 P.M.
d. Midnight

ANS: B DIF: Difficult REF: 2.2 OBJ: Applied
TOP: III.E

21. Assume you are observing the night sky from a typical city in the United States at a latitude of +40°. Use the figure below to determine which month it is if the zodiac constellation Taurus is on your meridian at midnight.



a. July
b. November
c. January
d. May

ANS: B DIF: Medium REF: 2.2 OBJ: Applied
TOP: III.E.i

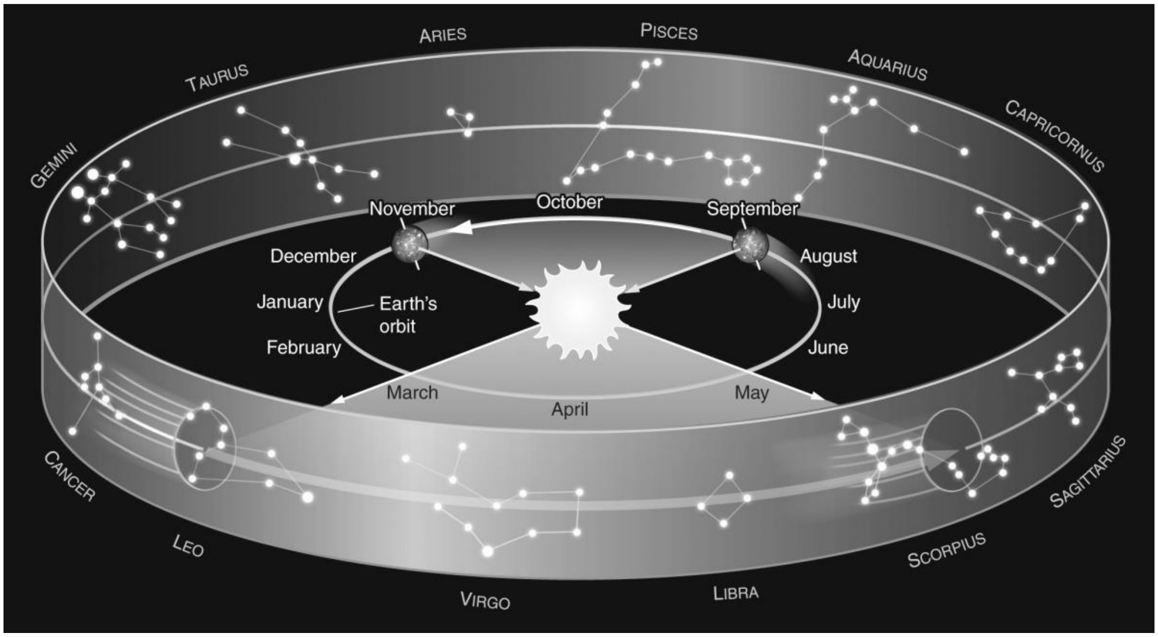
22. The shortest day of the year for a person living in the SOUTHERN Hemisphere is the:
a. summer solstice (June 1)
b. vernal equinox (March 21)
c. winter solstice (Dec. 22)
d. autumnal equinox (Sept. 23)

ANS: A DIF: Difficult REF: 2.2 OBJ: Applied
TOP: V.E.i

23. For a person who lives at a latitude of +40°, when is the Sun directly overhead at noon?
a. Only on the summer solstice
b. Only on the vernal and autumnal equinoxes
c. Never
d. Always

ANS: C DIF: Difficult REF: 2.2 OBJ: Applied
TOP: V.C

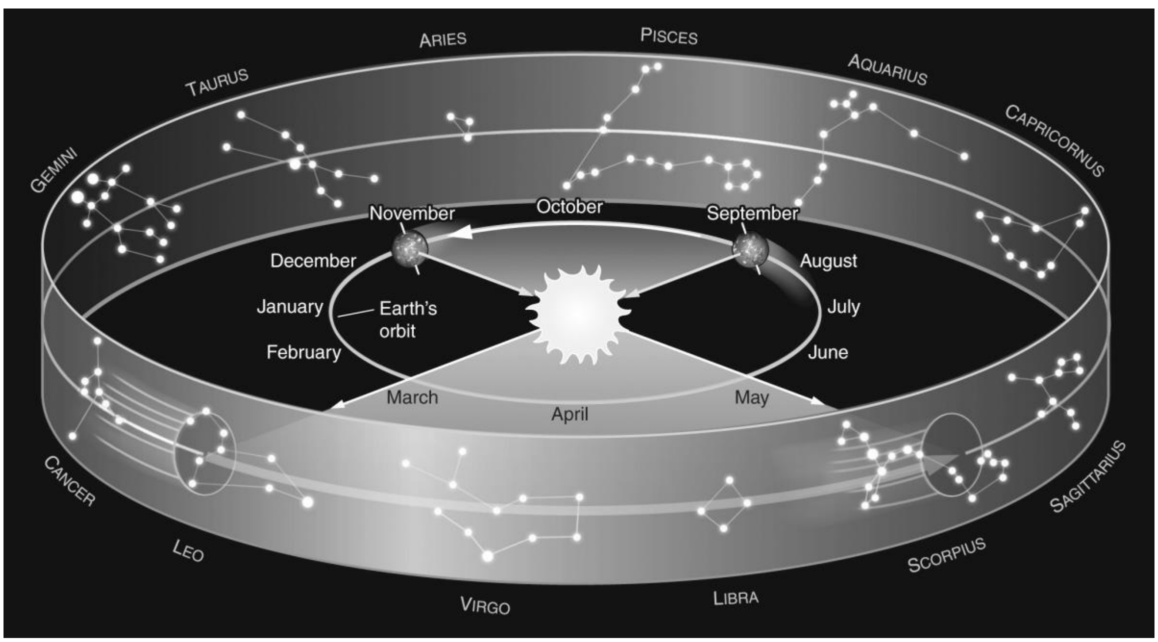
24. Assume you are observing the night sky from a typical city in the United States at a latitude of +40°. Use the figure below to determine which constellation of the zodiac would be nearest the meridian at 6 P.M. in September.



a. Scorpius
b. Gemini
c. Aquarius
d. Leo

ANS: A DIF: Difficult REF: 2.2 OBJ: Applied TOP: III.E.i

25. Assume you are observing the night sky from a typical city in the United States at a latitude of +40°. Use the figure below to determine which constellation of the zodiac would be rising at 10 P.M. in May.



a. Pisces
b. Virgo
c. Gemini
d. Sagittarius

ANS: D DIF: Difficult REF: 2.2 OBJ: Applied TOP: III.E.i

26. The Moon undergoes synchronous rotation, and as a consequence the:
    a. rotational period of the Moon equals the orbital period of the Moon around the Earth
    b. rotational period of the Moon equals the rotational period of the Earth
    c. rotational period of the Moon equals the orbital period of the Earth around the Sun
    d. Moon does not rotate as it orbits the Earth

    ANS: A DIF: Easy REF: 2.3 OBJ: Conceptual
    TOP: VI.B.i

27. In regard to the phase of the Moon, the term *waxing* means:
    a. less than half-illuminated
    b. more than half-illuminated
    c. becoming smaller
    d. increasing in brightness

    ANS: D DIF: Easy REF: 2.3 OBJ: Factual
    TOP: VII.A

28. If tonight the Moon is in the waxing gibbous phase, in three days the Moon will most likely be in the:
    a. new phase
    b. full phase
    c. third quarter phase
    d. first quarter phase

    ANS: B DIF: Easy REF: 2.3 OBJ: Applied
    TOP: VII.A

29. If there is a full Moon out tonight, approximately how long from now will it be in the third quarter phase?
    a. Three to four days
    b. One week
    c. Two weeks
    d. One month

    ANS: B DIF: Easy REF: 2.3 OBJ: Applied
    TOP: VII.A

30. Which of the following is FALSE?
    a. Everyone on Earth observes the same phase of the Moon on a given night.
    b. The phases of the Moon cycle with a period of approximately one month.
    c. In some phases, the Moon can be observed during the day.
    d. The observed phase of the Moon changes over the course of one night.

    ANS: D DIF: Easy REF: 2.3 OBJ: Applied
    TOP: VII.A

31. At what time does a third quarter Moon rise? (Hint: A third quarter Moon occurs approximately 3 weeks after a new Moon.)
    a. 12 midnight
    b. 12 noon
    c. 6 A.M.
    d. 6 P.M.

    ANS: A DIF: Medium REF: 2.3 OBJ: Applied
    TOP: VII.A

32. What time does a third quarter Moon rise?
    a. 12 midnight
    b. 12 noon
    c. 6 A.M.
    d. 6 P.M.

    ANS: A DIF: Difficult REF: 2.3 OBJ: Applied
    TOP: VII.A

33. At what time does the waxing gibbous phase rise?
a. 3 P.M.
b. 9 A.M.
c. 3 A.M.
d. 9 P.M.

ANS: A DIF: Difficult REF: 2.3 OBJ: Applied
TOP: VII.A

34. If a person on Earth currently views the Moon in a waxing crescent phase, in what phase would the Earth appear to a person on the Moon?
a. Waxing crescent
b. Waxing gibbous
c. Waning gibbous
d. Waning crescent

ANS: C DIF: Difficult REF: 2.3 OBJ: Applied
TOP: VII.B

35. During which lunar phase do solar eclipses occur?
a. New
b. First quarter
c. Full
d. Third quarter

ANS: A DIF: Easy REF: 2.4 OBJ: Conceptual
TOP: VIII.A.i

36. A partial lunar eclipse occurs when:
a. the Sun appears to go behind the Moon
b. the Moon passes through part of the Earth's shadow
c. the Moon shadows part of the Sun
d. the Earth passes through part of the Moon's shadow

ANS: B DIF: Easy REF: 2.4 OBJ: Conceptual
TOP: VIII.A.ii

37. Solar and lunar eclipses are rare because:
a. the Moon's orbital plane is tipped by 5.2° relative to the plane defined by the Earth's equator
b. the Moon's orbital plane is tipped by 5.2° relative to the Earth's orbital plane
c. the Moon's orbital plane is tipped by 23.5° relative to the plane defined by the Earth's equator
d. the Moon's orbital plane is tipped by 23.5° relative to the Earth's orbital plane

ANS: B DIF: Medium REF: 2.4 OBJ: Conceptual
TOP: VIII.B.i

38. Approximately how often do lunar eclipses occur?
a. Twice every year
b. Once per month
c. Twice every 11 months
d. Once every 11 years

ANS: C DIF: Difficult REF: 2.4 OBJ: Factual
TOP: VIII.B.ii

39. When the Earth catches up to a slower moving outer planet and passes it in its orbit like a faster runner overtakes a slower runner in an outside lane, the planet:
a. exhibits retrograde motion
b. slows down because it feels the Earth's gravitational pull
c. decreases in brightness as it passes through the Earth's shadow
d. moves into a more elliptical orbit

ANS: A DIF: Easy REF: 2.5 OBJ: Factual TOP: IX.B

40. If the Sun is located at one focus of Earth's elliptical orbit, what is at the other focus?
    a. Earth
    b. The Moon
    c. Nothing
    d. This is a trick question. An ellipse has only one focus.

ANS: C DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.C.i.a

41. The average distance between a planet and the Sun is given by the __________ of its elliptical orbit.
    a. radius
    b. minor axis
    c. eccentricity
    d. semimajor axis

ANS: D DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.C.i.a

42. Which of the following is TRUE about a comet that is on an elliptical orbit around the Sun?
    a. The comet's speed is greatest when it is farthest from the Sun.
    b. The comet's speed is greatest when it is nearest the Sun.
    c. This comet's speed is zero.
    d. The comet's speed is constant because its mass and the Sun's mass stay approximately the same.

ANS: B DIF: Easy REF: 2.5 OBJ: Applied
TOP: IX.C.ii

43. The time it takes a planet to complete one full orbital revolution is commonly known as its:
    a. period
    b. frequency
    c. orbital domain
    d. velocity

ANS: A DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.C.iii

44. Kepler's third law is a relationship between an orbiting object's:
    a. gravitational force and mass
    b. acceleration and mass
    c. velocity and period
    d. period and semimajor axis

ANS: D DIF: Easy REF: 2.5 OBJ: Factual
TOP: IX.C.iii

45. A circle has an eccentricity of __________ and a line has an eccentricity of __________.
    a. 1; 0
    b. 1; 1
    c. 0; infinity
    d. 0; 1

ANS: D DIF: Medium REF: 2.5 OBJ: Factual
TOP: IX.C.i.a

46. The eccentricity of the majority of the planetary orbits in our Solar System is approximately:
    a. 0
    b. 1
    c. 0.5
    d. 0.2

ANS: A DIF: Medium REF: 2.5 OBJ: Factual
TOP: IX.C.i.a

47. If you travel 20 miles from home to school in 30 minutes, what is your average velocity?
a. 20 mph
b. 40 mph
c. 0.7 mph
d. 5 mph

ANS: B DIF: Easy REF: Working It Out 2.1
OBJ: Applied TOP: IV.A

48. Kepler's third law can be expressed mathematically as:
a. $P = A$
b. $P^2 = A^2$
c. $P^2 = A^3$
d. $P^3 = A^2$

ANS: C DIF: Easy REF: Working It Out 2.2
OBJ: Factual TOP: IX.C.iii

49. Suppose an asteroid had an orbit with a semimajor axis of 4 AU. How long would it take for it to orbit once around the Sun?
a. 2 years
b. 4 years
c. 8 years
d. 16 years

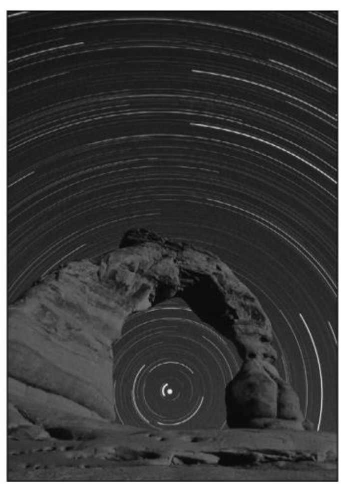
ANS: C DIF: Difficult REF: Working It Out 2.2
OBJ: Applied TOP: IX.C.iii

50. If Jupiter has an orbital period of 12 years, what is its average distance from the Sun?
a. 2 AU
b. 25 AU
c. 10 AU
d. 5 AU

ANS: D DIF: Difficult REF: Working It Out 2.2
OBJ: Applied TOP: IX.C.iii

SHORT ANSWER

1. The figure below is a time exposure of the sky, showing the motion of the stars through the night. What is the name for the stars that never rise or set below the horizon?



ANS:
Circumpolar stars

DIF: Easy REF: 2.1 OBJ: Factual TOP: II.C.i.a

2. The center of the Milky Way lies approximately 30° south of the celestial equator. From what latitudes on the Earth is it impossible to view the center of our galaxy?

ANS:
At latitudes > 90° – 30° = 60°, it would be impossible to see the center of our galaxy because it would lie below the horizon.

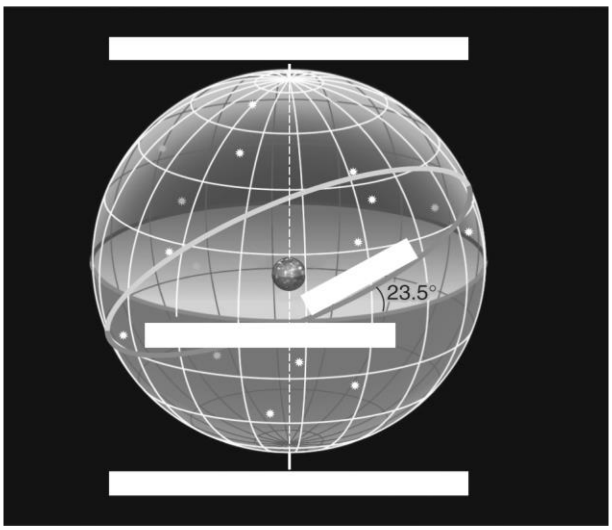
DIF: Easy REF: 2.1 OBJ: Applied TOP: II.C.i

3. On what place(s) on Earth can you stand and have the great circle of the celestial equator be at the same height relative to your horizon for all 360° of its circumference?

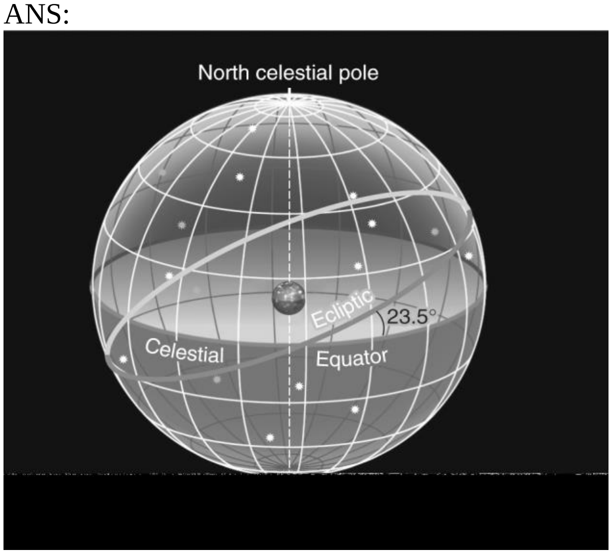
ANS:
You can stand at either the North Pole or the South Pole.

DIF: Medium REF: 2.1 OBJ: Applied TOP: II.A.ii

4. For the following figure, label the north and south celestial poles, the celestial equator, and the ecliptic.



ANS:



DIF: Medium REF: 2.1 OBJ: Factual TOP: II.A

5. How is the observed height of Polaris above the horizon related to an observer's latitude? (Hint: Consider three cases of observers located at the equator, the North Pole, and latitude = +45°.)

   ANS:
   The observed height of Polaris above the horizon is equal to an observer's latitude. For an observer at the equator (latitude = 0°), Polaris is on the horizon. For an observer at the North Pole (latitude = +90°), Polaris is at the zenith or 90° above the horizon. For an observer at latitude = +45°, Polaris is 45° above the horizon.

   DIF: Medium REF: 2.1 OBJ: Applied TOP: II.C.i.c

6. What would be the effect on the seasons if the tilt of the Earth's axis were 10° rather than 23.5°?

   ANS:
   If the tilt of the Earth's axis were smaller, there would be a less dramatic temperature shift between the seasons because the angle of the Sun's rays would vary less and the length of day/night would be more equal throughout the year.

   DIF: Easy REF: 2.2 OBJ: Applied TOP: V.D

7. Earth experiences seasons due to the tilt of its axis. What are the two consequences of this tilt that contribute to the seasons?

   ANS:
   (1) Variation in the length of day
   (2) Variation in the directness of the Sun's rays

   DIF: Medium REF: 2.2 OBJ: Applied TOP: V.D

8. What makes the equinoxes and solstices special?

   ANS:
   The equinoxes occur when the Sun is directly above the equator; the entire world experiences a 12-hour day and a 12-hour night. The solstices occur when the Sun is farthest from the equator (north or south). On these days, one hemisphere experiences its longest day and shortest night, while the other hemisphere experiences its shortest day and longest night.

   DIF: Medium REF: 2.2 OBJ: Factual TOP: V.E

9. For an observer in Seattle, Washington, which is located at latitude = +47°, what is the minimum height above the southern horizon that the Sun will have throughout the year, and approximately when will this occur?

   ANS:
   The Sun will be at its minimum height above the southern horizon at noon on the winter solstice (Dec. 22). In Seattle at a latitude of +47°, the celestial equator will have a height of 90° – 47° = 43° above the southern horizon. Because the Earth's axis is tilted by 23.5° relative to the direction perpendicular to its orbital plane around the Sun, the Sun will reach a height of 43° – 23.5° = 19.5° above the southern horizon at noon on the winter solstice.

   DIF: Difficult REF: 2.2 OBJ: Applied TOP: V.C

10. The figure below shows four locations of the sun on the ecliptic. Label each appropriately with the labels: autumnal equinox, vernal equinox, summer solstice, and winter solstice.

ANS:

DIF: Medium REF: 2.2 OBJ: Factual TOP: V.E

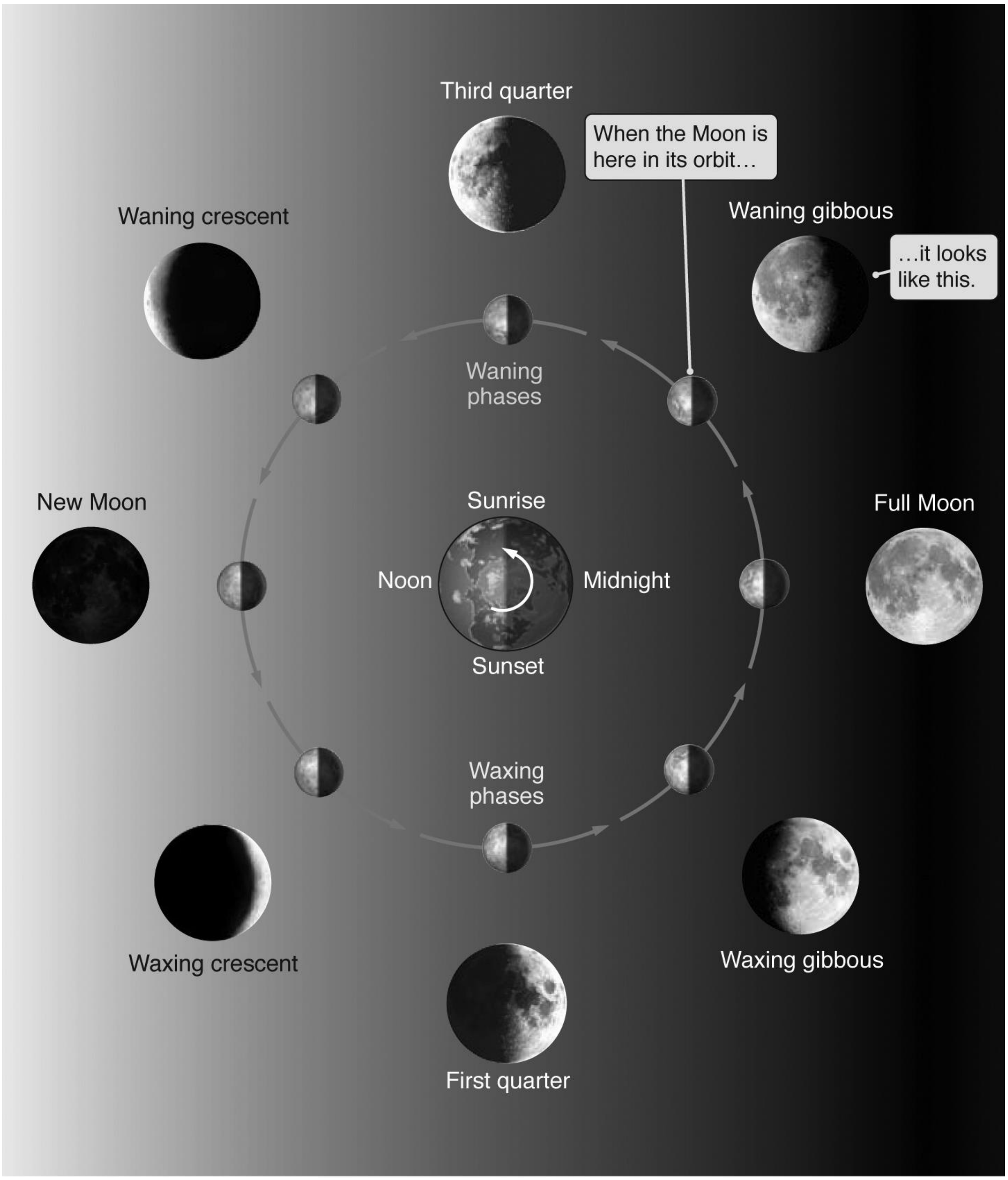
11. On which great celestial circle(s) on the celestial sphere would you find the position of the autumnal equinox?

ANS:
On both the celestial equator and the ecliptic planes.

DIF: Difficult REF: 2.2 OBJ: Factual TOP: V.E.ii

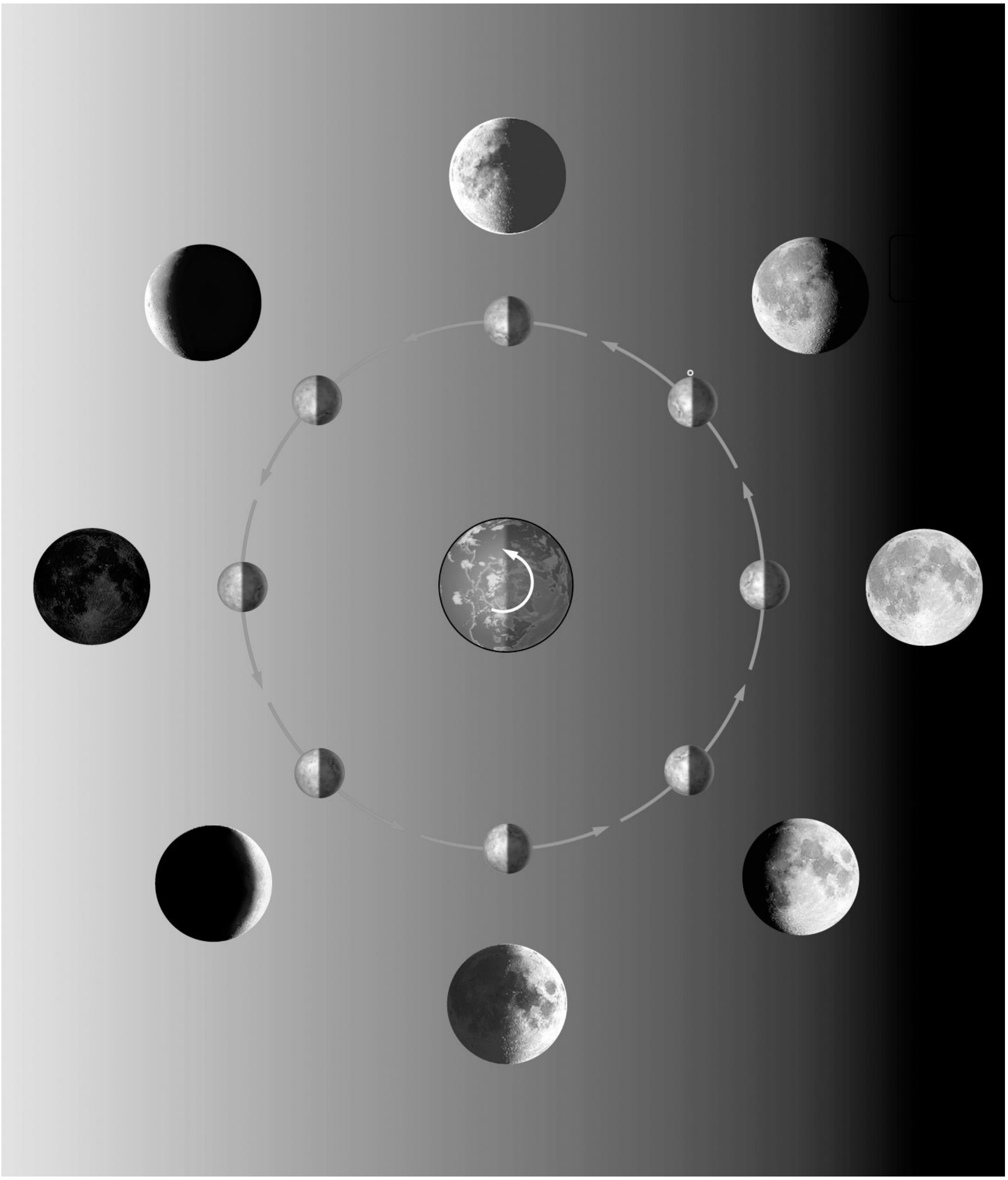
12. The figure below shows the different phases of the moon. Label each phase of the moon shown.

ANS:
The answer appears on the following page.

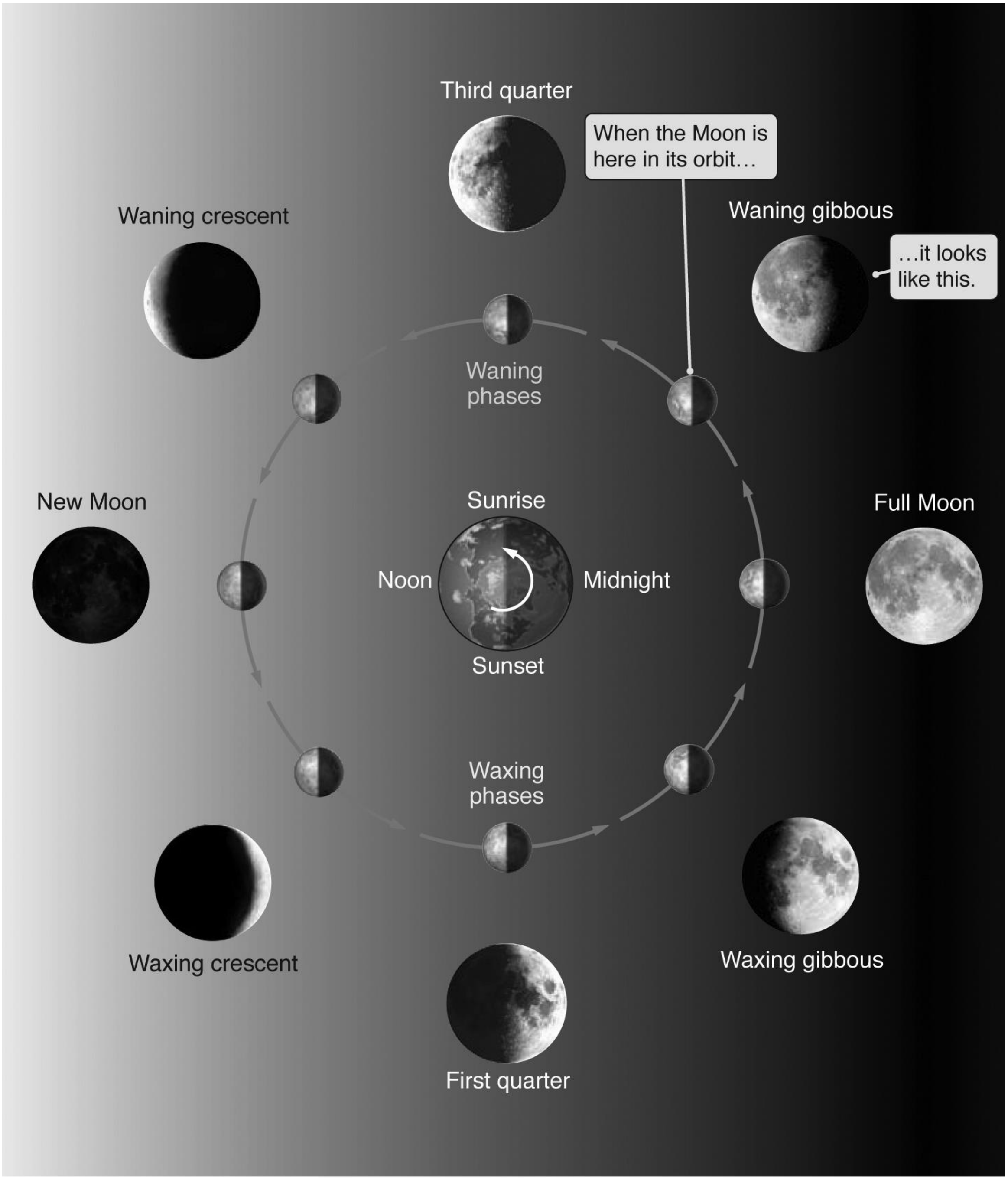


DIF: Medium REF: 2.3 OBJ: Factual TOP: VII.B

13. The figure below shows the different phases of the Moon. Label each phase of the Moon. Approximately what time would the full Moon rise above your horizon? The third quarter Moon? The new Moon? The first quarter Moon?



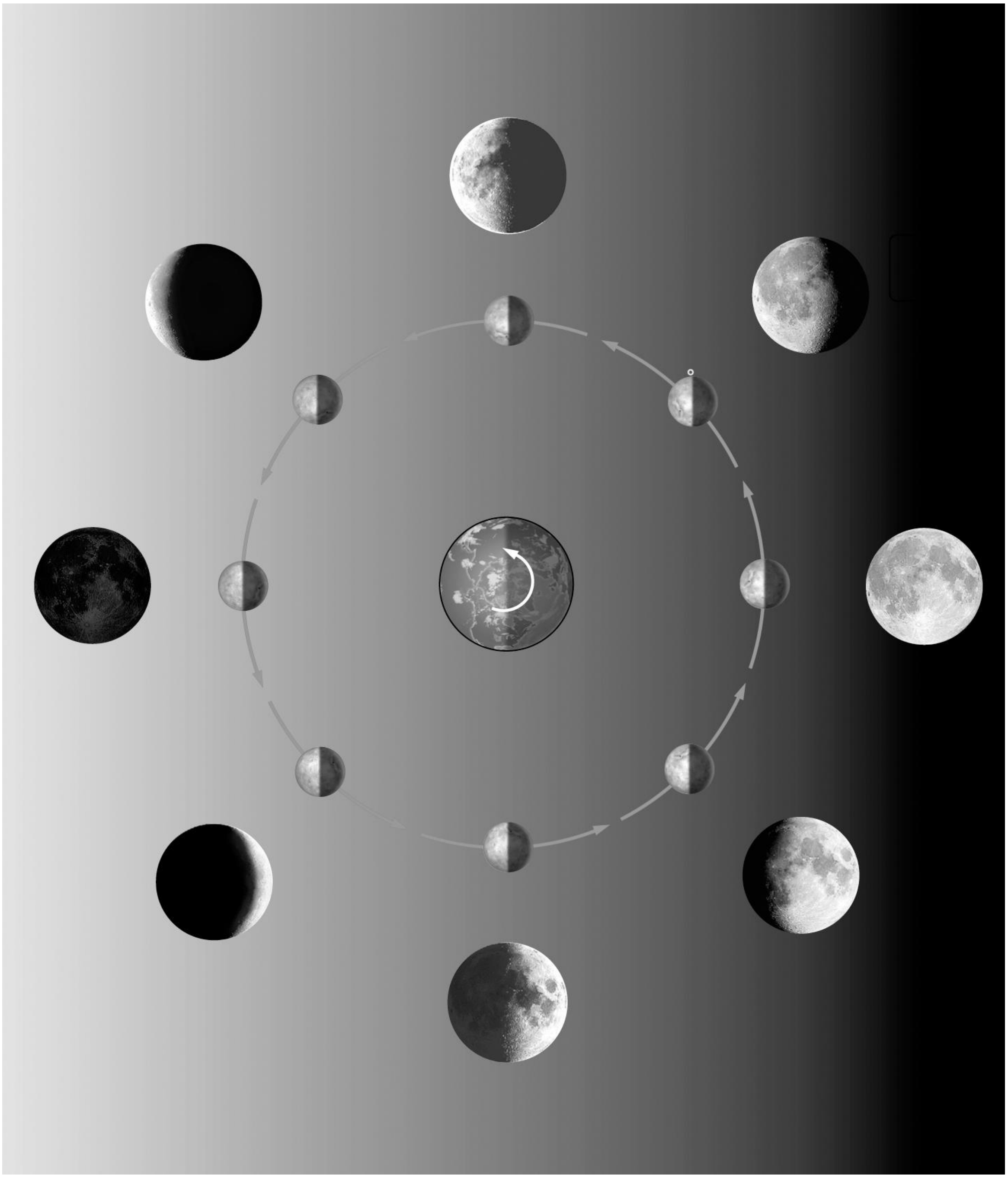
ANS:
The answer appears on the following page.



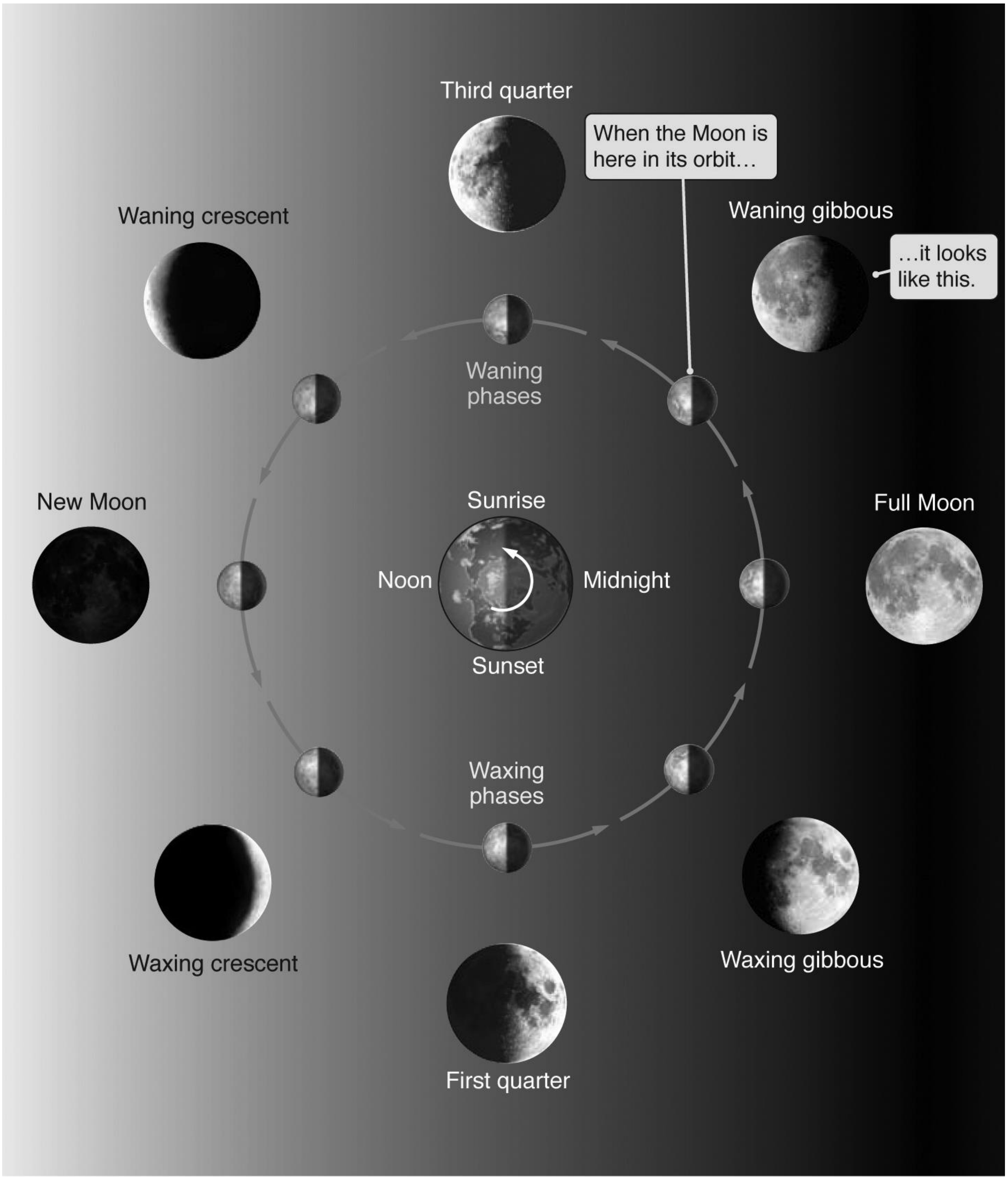
The full Moon would rise at sunset. The third quarter Moon would rise at midnight. The new Moon would rise at sunrise. The first quarter Moon would rise at noon.

DIF: Medium REF: 2.3 OBJ: Conceptual TOP: VII.B

14. The figure below shows the different phases of the Moon. Label each phase of the Moon. What time would the full Moon be on your meridian? The new Moon?



ANS:
The answer appears on the following page.



The full Moon would be on the meridian at midnight. The new Moon would be on the meridian at noon.

DIF: Medium REF: 2.3 OBJ: Conceptual TOP: VII.B

15. Explain why we always see the same side of the Moon from Earth.

ANS:
The amount of time it takes for the Moon to rotate once about its axis is exactly equal to the amount of time it takes to orbit once around Earth.

DIF: Medium REF: 2.3 OBJ: Conceptual TOP: VI.B.i

16. If the Moon was full three days ago, what phase will it be tonight and when will it rise and set?

ANS:
The Moon's phase cycles on a 29.5 day period. Therefore the Moon tonight will be approximately halfway between the full and third quarter phases, and thus it will be in the waning gibbous phase. It will be on an observer's eastern horizon and rising halfway between 6 P.M. and midnight, which is 9 P.M. It will set 12 hours later at 9 A.M.

DIF: Difficult REF: 2.3 OBJ: Applied TOP: VII.B

17. The figure below shows a solar eclipse. What type of solar eclipse is it?

ANS:
An annular solar eclipse.

DIF: Easy REF: 2.4 OBJ: Factual TOP: VIII.A.i

18. What do we customarily call the semimajor axis of a circle? What is the value of the eccentricity of a circle? What would the value of the eccentricity be for a comet on a very elliptical orbit around the Sun?

ANS:
The radius of the circle. The eccentricity of a circle is 0. The eccentricity of a comet on a very elliptical orbit around the Sun would be close to 1.0.

DIF: Easy REF: 2.5 OBJ: Factual TOP: IX.C.i.a

19. Earth has an average radius of approximately 6.4×10^3 km. What is the average speed of the ground due to the rotation of Earth at its equator in km/s if there are 8.64×10^4 seconds per day?

ANS:
Here the students need to convert the radius of Earth to its circumference: $C = 2\pi r = 4.02 \times 10^4$ km. Divide this distance by the number of seconds, and we get a speed of 0.465 km/s = 1676 km/hr.

DIF: Difficult REF: Working It Out 2.1 OBJ: Applied
TOP: I.A | IV.A

20. Saturn has a semimajor axis of 9.6 AU. How long does it take Saturn to orbit once around the Sun?

    ANS:
    Using Kepler's third law $P^2 = A^3$, and comparing it to the Earth's orbital period of 1 year and semimajor axis of 1 AU, Saturn's period P is equal to $(P/1\ \text{yr})^2 = (9.6\ \text{AU}/1\ \text{AU})^3$ gives us $P = 1\ \text{yr} \times (9.6)^{3/2} = 9.6^{1.5}\ \text{yr} = 30\ \text{yr}$.

    DIF: Difficult REF: Working It Out 2.2 OBJ: Applied
    TOP: IX.C.iii