**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

1) Which of the following statements about the celestial equator is true at *all* latitudes? 1) _____
A) It extends from your horizon due east, through your zenith, to your horizon due west.
B) It represents an extension of Earth's equator onto the celestial sphere.
C) It extends from your horizon due north, through your zenith, to your horizon due south.
D) It lies along the band of light we call the Milky Way.
E) It cuts the dome of your local sky exactly in half.

2) When we look into the band of light in our sky that we call the Milky Way, can we see distant galaxies? Why or why not? 2) _____
A) No, because the stars, gas, and dust of the Milky Way block us from seeing them.
B) Yes, there are many other galaxies that we see inside the Milky Way.
C) Yes, they appear as small, fuzzy patches on the other side of our galaxy.
D) No, because there are only galaxies above and below the plane of the Milky Way.

3) If it is midnight in New York, it is 3) _____
A) midnight everywhere.
B) daytime in Sydney, Australia.
C) midnight in Los Angeles.
D) midnight in Sydney, Australia.
E) midday in Rio de Janeiro, Brazil.

4) How many arcseconds are in one degree? 4) _____
A) 100 B) 10,000 C) 3,600 D) 60 E) 360

5) What is a *circumpolar* star? 5) _____
A) a star that is close to the north celestial pole
B) a star that is close to the south celestial pole
C) a star that is visible from the Arctic or Antarctic circles
D) a star that always remains above your horizon
E) a star that makes a daily circle around the celestial sphere

6) Which of the following statements about circumpolar stars is true at *all* latitudes? 6) _____
A) They make relatively small circles, traveling clockwise around the north celestial pole.
B) They are the stars close to the north celestial pole.
C) You cannot see them from the Southern Hemisphere.
D) They always remain above your horizon.
E) Like all other stars, they rise in the east and set in the west.

7) What makes the North Star, Polaris, special? 7) _____
A) It is the star straight overhead.
B) It is the brightest star in the sky.
C) It appears very near the north celestial pole.
D) It can be used to determine your longitude on Earth.
E) It is the star directly on your northern horizon.

8) You are standing on Earth's equator. Which way is Polaris, the North star? 8) _____
A) on the northern horizon
B) 30 degrees up, due West
C) directly overhead
D) The answer depends on whether it's winter or summer.
E) The answer depends on what time of day (or night) it is.

9) By locating the north celestial pole (NCP) in the sky, how can you determine your latitude? 9) _____
A) The altitude of the NCP is the same as your distance from the North Pole.
B) The altitude of the NCP is the same as your latitude.
C) The altitude of the NCP is your angular distance from the North Pole.
D) The direction of the NCP is the angular distance from the North Pole.
E) The direction of the NCP is the same as your latitude.

10) Orion is visible on winter evenings but not summer evenings because of 10) _____
A) baseball on television.
B) the precession of Earth's axis.
C) the tilt of Earth's axis.
D) interference from the full moon.
E) the location of Earth in its orbit.

11) Why is it summer in the Northern Hemisphere when it is winter in the Southern Hemisphere? 11) _____
A) The Northern Hemisphere is tilted away from the Sun and receives more indirect sunlight.
B) The Northern Hemisphere is "on top" of Earth and therefore receives more sunlight.
C) The Northern Hemisphere is tilted toward the Sun and receives more direct sunlight.
D) The Northern Hemisphere is closer to the Sun than the Southern Hemisphere.
E) It isn't; both hemispheres have the same seasons at the same time.

12) Which of the following statements is *true*? 12) _____
A) Both the Northern and Southern hemispheres receive the same amount of sunlight on the equinoxes.
B) The Southern Hemisphere receives the most direct sunlight on the summer solstice.
C) The Northern Hemisphere receives the most direct sunlight on the summer solstice.
D) Both the Northern and Southern hemispheres receive the same amount of sunlight on the solstices.
E) Both A and C are true.

13) Which of the following statements about constellations is *false*? 13) _____
A) Most constellations will be unrecognizable hundreds of years from now.
B) There are only 88 official constellations.
C) It is possible to see all the constellations from Earth's equator.
D) Some constellations can be seen in both the winter and summer.
E) Some constellations can be seen from both the Northern and Southern hemispheres.

14) Which of the following statements about lunar phases is *true*? 14) _____
A) It is possible to have two full moons during January, but not during February.
B) The time from one new moon to the next new moon is the same as the time from first-quarter moon to third-quarter moon.
C) The full moon sometimes rises around midnight.
D) The time between new moons is two weeks.
E) It is possible to have two full moons during November, but not during December.

15) Which of the following is *not* a phase of the Moon? 15) _____
A) first-quarter moon
B) full moon
C) third-quarter moon
D) half moon
E) new moon

16) When someone on Earth observes the Moon in the first-quarter phase, someone on the Moon facing Earth observes Earth in the 16) _____
A) new Earth phase.
B) first-quarter Earth phase.
C) third-quarter Earth phase.
D) crescent Earth phase.
E) full Earth phase.

17) If the Moon is setting at 6 A.M., the phase of the Moon must be 17) _____
A) waning crescent.
B) first quarter.
C) third quarter.
D) new.
E) full.

18) If the Moon is setting at noon, the phase of the Moon must be 18) _____
A) first quarter.
B) third quarter.
C) waning crescent.
D) waxing crescent.
E) full.

19) If the Moon is rising at midnight, the phase of the Moon must be 19) _____
A) first quarter.
B) third quarter.
C) waning crescent.
D) waxing crescent.
E) full.

20) At approximately what time would a full moon be on your meridian? 20) _____
A) 6 A.M. B) midnight C) noon D) 6 P.M. E) 9 A.M.

21) At approximately what time would a first quarter moon rise? 21) _____
A) 6 P.M. B) midnight C) 6 A.M. D) noon E) 9 A.M.

22) If the Moon rises around 3 A.M., its phase must be 22) _____
A) waxing crescent.
B) full.
C) waning crescent.
D) third quarter.
E) first quarter.

23) In which direction does a quarter moon rise? 23) _____
A) south
B) north
C) east
D) west
E) The Moon becomes a quarter moon only after it has risen and changed phase.

24) Which of the following statements about the Moon is true? 24) _____
A) If you see a full moon from North America, someone in South America would see a new moon.
B) The Moon is visible only at night.
C) The Moon's distance from Earth varies during its orbit.
D) The Moon goes through a cycle of phases because it always has the same side facing Earth.
E) The side of the Moon facing away from Earth is in perpetual darkness.

25) What effect or effects would be most significant if the Moon's orbital plane were exactly the same as the ecliptic plane? 25) _____
A) Solar eclipses would be much rarer.
B) Solar eclipses would be much more frequent.
C) Total solar eclipses would last much longer.
D) both A and C
E) both B and C

26) What conditions are required for a solar eclipse? 26) _____
A) The phase of the Moon can be new or full, and the nodes of the Moon's orbit must be nearly aligned with Earth and the Sun.
B) The phase of the Moon must be full, and the Moon's orbital plane must lie in the ecliptic.
C) The phase of the Moon must be new, and the Moon's orbital plane must lie in the ecliptic.
D) The phase of the Moon must be full, and the nodes of the Moon's orbit must be nearly aligned with Earth and the Sun.
E) The phase of the Moon must be new, and the nodes of the Moon's orbit must be nearly aligned with Earth and the Sun.

27) What conditions are required for a lunar eclipse? 27) _____
A) The phase of the Moon can be new or full, and the nodes of the Moon's orbit must be nearly aligned with Earth and the Sun.
B) The phase of the Moon must be new, and the nodes of the Moon's orbit must be nearly aligned with Earth and the Sun.
C) The phase of the Moon must be full, and the Moon's orbital plane must lie in the ecliptic.
D) The phase of the Moon must be new, and the Moon's orbital plane must lie in the ecliptic.
E) The phase of the Moon must be full, and the nodes of the Moon's orbit must be nearly aligned with Earth and the Sun.

28) In addition to the conditions required for any solar eclipse, what must also be true in order for you to observe a *total* solar eclipse? 28) _____
A) Earth must lie completely within the Moon's penumbra.
B) The Moon's penumbra must touch the area where you are located.
C) Earth must lie completely within the Moon's umbra.
D) Earth must be near aphelion in its orbit of the Sun.
E) The Moon's umbra must touch the area where you are located.

29) If part of the full moon passes through Earth's umbra, we will see a(n) 29) _____
A) partial solar eclipse.
B) annular eclipse.
C) penumbral lunar eclipse.
D) total lunar eclipse.
E) partial lunar eclipse.

30) If the Moon is relatively far from Earth, so that its umbra does not reach Earth, someone directly behind the umbra will see 30) _____
A) an annular eclipse.
B) a partial solar eclipse.
C) a partial lunar eclipse.
D) no eclipse.
E) a penumbral lunar eclipse.

31) When are eclipse seasons? 31) _____
A) during an eclipse
B) in the spring and fall
C) when the nodes of the Moon's orbit are nearly aligned with the Sun
D) when Earth, the Sun, and the Moon are exactly aligned for an eclipse
E) in the summer and winter

32) The precession of the Moon's nodes means that 32) _____
A) the vernal equinox will be in Aquarius in a few hundred years.
B) there is a lunar eclipse every 6 months.
C) the eclipse seasons occur less than 6 months apart.
D) there are never two solar eclipses in the same year.
E) there is a solar eclipse every 6 months.

33) Ancient people who knew the saros cycle could 33) _____
A) predict what type of eclipse would occur.
B) predict when they'd see the next total solar eclipse in their area.
C) predict when an eclipse would happen, but not necessarily what type and where it would be visible.
D) completely predict every solar eclipse.
E) completely predict every lunar eclipse.

34) What happens during the apparent retrograde motion of a planet? 34) _____
A) The planet appears to move eastward with respect to the stars over a period of many nights.
B) The planet moves through constellations that are not part of the zodiac.
C) The planet moves backward in its orbit around the Sun.
D) The planet moves backward through the sky.
E) The planet rises in the west and sets in the east.

35) What causes the apparent retrograde motion of the planets? 35) _____

A) Apparent retrograde motion is an illusion created by turbulence in Earth's atmosphere.
B) When planets are farther from the Sun, they move slower than when they are nearer the Sun; it is during this slower period that they appear to move backwards.
C) As Earth passes another planet, the other planet appears to move backward with respect to the background stars, but the planet's motion does not really change.
D) The other planets never really appear to move backward; the background stars shift due to Earth's revolution around the Sun.
E) As Earth passes another planet, its gravitational pull slows down the other planet so that it appears to be traveling backward.

36) Which of the following never goes in retrograde motion? 36) _____

A) Venus B) Saturn C) the Sun D) Mars E) Jupiter

37) Which of the following statements about parallax is *not* true? 37) _____

A) The existence of stellar parallax is direct proof that Earth orbits the Sun.
B) Measurement of stellar parallax allows us to determine distances to nearby stars.
C) The technique of stellar parallax was used by Hubble to determine that the Andromeda Galaxy (M 31) is about 2 million light-years away.
D) Ancient astronomers were unable to measure parallax and used the absence of observed parallax as an argument in favor of an Earth-centered universe.
E) You can demonstrate parallax simply by holding up a finger and looking at it alternately from your left and right eyes.

38) Which of the following statements about stellar parallax is *true*? 38) _____

A) We observe all stars to exhibit at least a slight amount of parallax.
B) The closer a star is to us, the more parallax it exhibits.
C) It takes at least 10 years of observation to measure a star's parallax.
D) The amount of parallax we see depends on how fast a star is moving relative to us.
E) Stellar parallax was first observed by ancient Greek astronomers.

39) We can't detect stellar parallax with naked-eye observations. Which of the following would make parallax easier to observe? 39) _____

A) slowing down Earth's orbital motion
B) getting away from streetlights
C) Speeding up the precession of Earth's axis
D) speeding up Earth's orbital motion
E) increasing the size of Earth's orbit

40) Why were ancient peoples unable to detect stellar parallax? 40) _____

A) They did not have the ability to measure very small angles.
B) They did not look for it.
C) They could not see distant stars.
D) They did not observe for long enough periods of time.
E) They did detect it, but they rejected the observations.

41) How many arcseconds are in one arcminute? 41) _____

A) 60 B) 10,000 C) 100 D) 3600 E) 360

42) How many arcminutes are in one degree? 42) _____

A) 60 B) 100 C) 3600 D) 10,000 E) 360

43) Has Polaris always been the "North Star"? 43) _____
A) No, because it is a young star that only formed a few hundred years ago.
B) No, because the Earth's axis slowly changes the direction it points.
C) No, because the Milky Way blocked our line of site to it for a long time.
D) Yes, because the stars are unchanging.

44) If you see Polaris directly overhead at midnight, you must be at 44) _____
A) the South Pole. B) the North Pole.
C) the equator. D) the Tropic of Cancer.

45) You experience night-time when 45) _____
A) the side of the Earth you occupy is facing away from the Sun.
B) the Earth's axis precesses.
C) the Earth revolves 90 degrees in its orbit.
D) the Moon blocks the Sun's light.

46) If the Moon is setting at noon, then it rose at 46) _____
A) noon. B) 6 A.M. C) 6 P.M. D) midnight. E) 9 A.M.

**TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.**

47) In South Africa, it's usually quite warm around the time of the December solstice and quite cool around the time of the June solstice. 47) _____

48) You can find the tilt of Earth's axis by measuring the angle between your horizon and the North Star. 48) _____

49) The Milky Way can be seen only from the Northern Hemisphere. 49) _____

50) The seasons on Earth are caused by its elliptical orbit around the Sun. 50) _____

51) At midnight it is sometimes possible to observe the crescent moon on the meridian. 51) _____

52) It is possible to see the third-quarter moon near the western horizon at sunrise. 52) _____

53) It is possible to see the full moon rising just before sunrise. 53) _____

54) If you lived on the Moon, you'd see full Earth when we see new moon. 54) _____

55) It is possible to view the Moon in first-quarter phase the day after a total lunar eclipse. 55) _____

56) The Moon and the Sun are approximately the same angular size. 56) _____

57) A solar eclipse occurs only when the Moon is new. 57) _____

58) A lunar eclipse occurs only when the Moon is new. 58) _____

59) The Moon and Sun are approximately the same physical size. 59) _____

**ESSAY. Write your answer in the space provided or on a separate sheet of paper.**

60) *Models in Science*: Models play a central role in astronomy and science in general. Two models used extensively in this chapter are the celestial sphere and the heliocentric (Sun-centered) model for the solar system. Astronomers clearly believe that the celestial sphere model is *false* and the heliocentric model is *true*. Given this, why do you think astronomers persist in using the celestial sphere model to describe the night sky?

61) *Cognitive Dissonance*? You are talking to a friend who insists that the seasons are caused by a varying Earth-Sun distance over the course of a year. What other fact does your friend likely know that completely contradicts this view of how the seasons are caused? Can you think of other examples of two beliefs that many people feel are both true but which completely contradict each other? How does science view this situation?

62) *The Sidereal Day*: Using your wristwatch and observations of the night sky over the course of a few weeks, how can you demonstrate to a friend that 24 hours cannot be the true rotation period of the Earth (often called the sidereal day)? What assumptions do you make in this argument?

63) *Scientific Reasoning*: The scientific method requires that we put any hypothesis about how the universe works to the test by conducting observations of the natural world. Consider the Greek reaction to the idea of a heliocentric (Sun-centered) solar system. Why did most Greeks reject this hypothesis in favor of the geocentric (Earth-centered) model? Do you think that the Greeks were following a scientific form of reasoning to reach this conclusion? Does the fact that the Greeks reached the *wrong* conclusion affect your answer?

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

*The choices below are for the following questions. For each question, choose the letter for the real motion that is responsible for the apparent motion as seen from Earth.*

A. Earth rotates once each day.
B. Earth revolves around the Sun once each year.
C. The direction of Earth's axis in space precesses with a period of 26,000 years.
D. Stars appear to move randomly in the local solar neighborhood.
E. The universe is expanding.

64) Polaris will no longer be the North Star 1,000 years from now. 64) _____

65) In the year A.D. 15,000, Vega will be a better north star than Polaris. 65) _____

66) The Big Dipper will look different 100,000 years from now than it does today. 66) _____

67) The Moon rises in the east and sets in the west. 67) _____

68) The stars of Orion's belt rise in the east and set in the west. 68) _____

69) A million years from now, Alpha Centauri will no longer be the nearest star system to our own. 69) _____

70) The stars visible at night change over the course of the year. 70) _____

71) The stars visible just after sunset are different from those visible just before sunrise. 71) _____

72) If Earth's axis had no tilt, would we still have seasons? Why or why not? 72) _____

73) Consider the following statement, and explain whether or not it is sensible: If you had a very fast spaceship, you could travel to the celestial sphere in about 100 years. 73) _____

74) Consider the following statement, and explain whether or not it is sensible: When I looked into the dark fissure of the Milky Way with my binoculars, I saw what must have been a cluster of distant galaxies. 74) _____

75) Why does the Milky Way appear as a *band* of light in the sky? 75) _____

76) Consider the following statement, and explain whether or not it is sensible: Although all the known stars appear to rise in the east and set in the west, we might someday discover a star that will appear to rise in the west and set in the east. 76) _____

77) At what altitude and in what direction in your sky does the north or south celestial pole appear? 77) _____

78) Consider the following statement, and explain whether or not it is sensible: My sign is Ursa Major because the Sun was in Ursa Major when I was born. 78) _____

79) Consider the following statement, and explain whether or not it is sensible: Last night I saw Jupiter in the constellation Ursa Major. 79) _____

80) Answer each of the following questions for our local sky. 80) _____
   A. Where is the north celestial pole in our sky?
   B. Is Polaris a circumpolar star in our sky? Explain.
   C. Describe the meridian in our sky.
   D. Describe the celestial equator in our sky.

81) Consider the following statement, and explain whether or not it is sensible: If you lived on the Moon, you'd see full Earth when we see new moon. 81) _____

82) Suppose you lived on the Moon near the center of the face that we see from Earth. During the phase of full moon, what phase would you see for Earth? Would it be day or night at your home? 82) _____

83) Suppose you lived on the Moon near the center of the face that we see from Earth. During the phase of new moon, what phase would you see for Earth? Would it be day or night at your home? 83) _____

84) Suppose you lived on the Moon near the center of the face that we see from Earth. At what phase of the Moon would you see sunset? What phase of Earth would you see at this time? 84) _____

85) Suppose you lived on the Moon near the center of the face that we see from Earth. At what phase of the Moon would you see sunrise? What phase of Earth would you see at this time? 85) _____

86) What would you see if you were on the near side of the Moon during a lunar eclipse? 86) _____

87) Why is the Moon *not* completely invisible (it appears as a very deep red color) to the naked eye during a total lunar eclipse? 87) _____

88) What would you see on Earth if you were on the near side of the Moon during a solar eclipse? 88) _____

89) Suppose the distance to the Moon were twice its actual value. Could we still have solar eclipses? If so, what type(s)? 89) _____

90) Consider the following statement, and explain whether or not it is sensible: Last night I saw Mars move westward through the sky in its apparent retrograde motion. 90) _____

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

91) If the Earth's rotation axis were tilted by 45 degrees instead of 23.5 degrees, what are some of the implications, and why? 91) _____
A) The seasons would be more extreme, because the surface of the Earth would be closer to the Sun in the summer, and farther from the Sun in the winter.
B) The seasons would be more extreme, because the Sun's rays would be more direct in summer, and less direct in winter.
C) The seasons would be less extreme, because the surface of the Earth would be farther from the Sun in the summer, and closer to the Sun in the winter.
D) The seasons would be less extreme, because the Sun's rays would be less direct in summer, and more direct in winter.

92) You see a crescent Moon setting after the Sun sets. Is it waning or waxing? 92) _____
A) can't distinguish based on the information provided
B) waning
C) waxing

93) Tonight, your telescope shows you RXJ1800, a galaxy, very near in the sky to the bright star Vega. What can you conclude from this observation? 93) _____
A) Vega and RXJ1800 must be very close to each other, less than a few light years.
B) Vega orbits the center of mass of RXJ1800.
C) RXJ1800 and Vega will drift apart from each other on the sky, over a matter of nights.
D) RXJ1800 and Vega will set in the west, at very similar times.

94) If the Sun passes almost in front of the center of our Milky Way Galaxy, it does so 94) _____
A) only in 2012, at the end of the Mayan calendar.
B) once a day.
C) once a year.
D) once a month.

95) The Greeks rejected the notion that the Earth orbits the Sun. Why? 95) _____
A) They could not measure a change in stars' positions on the sky.
B) They believed that the Sun is a God.
C) They weren't as smart as we are.
D) They could not measure how big the Earth was.

96) Your friend tells you that last night, they saw Mars high in the sky at midnight. You conclude that 96) _____
A) Mars must be in retrograde.
B) Mars must be at its farthest distance from the Earth.
C) Mars must be at its closest distance from the Sun.
D) Your friend must be mistaken: Mars can never be seen at midnight.

97) If the Moon is 3rd quarter phase, when does it rise? 97) _____
A) sunset B) noon C) never D) sunrise E) midnight

98) The Moon's orbit around the Earth is tilted by about 5 degrees with respect to Earth's orbit around the Sun. As a result, the approximate number of solar eclipses that occur each year is approximately 98) _____
A) 24. B) 0. C) 2. D) 12.

99) During a lunar eclipse the Moon's phase must be 99) _____
A) full. B) 1st quarter. C) new. D) 3rd quarter.

100) If the Moon is 3rd quarter phase, what shape does it have in the sky? 100) _____
A) a full circle
B) a half circle
C) a quarter circle
D) nothing (It is impossible to view a 3rd quarter moon.)

101) Which planet is moving most slowly around the Sun? 101) _____
A) Earth
B) Venus
C) Jupiter
D) They are all moving with the same speed around the Sun.

102) Which of these (hypothetical) modifications would cause lunar eclipses to happen once per month? 102) _____
A) Make the Moon orbit the Earth twice as fast.
B) Change the orbital plane of the Moon so it lies in the same plane as Earth's orbit around the Sun.
C) Change the Moon's orbital plane so it tilts the opposite way.
D) Relocate the Moon to twice its current distance from the Earth.

103) The Moon is nearly tidally locked to the Earth, which means the Moon's rotation period is almost the same as its orbital period. If you were camped at the equator of the Moon, you would experience (approximately) 103) _____
A) (14 × 24) hours of darkness followed by (14 × 24) hours of sunshine.
B) sunshine (day) all the time.
C) 14 hours of darkness followed by 14 hours of sunshine.
D) sunshine all the time, except when the Earth blocks the Sun.

104) "Gibbous" means a nearly full moon. If I see a waxing gibbous moon tonight, what moon phase will I see in one week? 104) _____
A) waxing crescent B) waning crescent
C) waning gibbous D) waxing gibbous

105) Which of the following conditions must exist for a solar eclipse to occur? 105) _____
A) The only condition is that the phase of the Moon must be full.
B) Moon phase is full, and the Moon is passing through the Earth's orbital plane.
C) The only condition is that the phase of the Moon must be new.
D) Moon phase is new, and the Moon is passing through the Earth's orbital plane.

106) Which of the following situations would result in the longest days during the summer? (Assume an axis tilt of 0 degrees is an axis perpendicular to the ecliptic plane.) 106) _____
A) axis tilt -10 degrees
B) axis tilt 90 degrees
C) axis tilt 23.5 degrees
D) axis tilt 0 degrees

107) About how many stars are visible to the naked eye on a clear, dark night away from city lights? 107) _____
A) a few dozen
B) a few hundred billion
C) a couple thousand
D) several million

108) What do astronomers mean by a *constellation*? 108) _____
A) A constellation is a region in the sky as seen from Earth.
B) A constellation is a group of stars related through an ancient story.
C) A constellation is a group of stars that are all located in about the same place in space.
D) A constellation is any random grouping of stars in the sky.

109) What is the *ecliptic*? 109) _____
A) a half-circle extending from your horizon due north, through your zenith, to your horizon due south
B) the path traced by the Moon's shadow on Earth during a solar eclipse
C) the path the Sun appears to trace around the celestial sphere each year
D) the Sun's daily path from east to west in our sky

110) What is the *celestial sphere*? 110) _____
A) The celestial sphere is a model of how the stars are arranged in the sky relative to our Sun, which is in the middle of the sphere.
B) It represents a belief in an Earth-centered universe, and hence is no longer considered to have any use.
C) The celestial sphere is a representation of how the entire sky looks as seen from Earth.
D) The celestial sphere is a model that shows the true locations in space of the Sun and a few thousand of the nearest stars.

111) What do we mean when we talk about the *Milky Way* in our sky? 111) _____
A) the whitish patch of light we see when we look toward the *center* of the Milky Way Galaxy
B) the patchy band of light that outlines the *plane* of the Milky Way Galaxy as seen from Earth
C) the spiral-shaped galaxy in which we live
D) the bright stars of the constellations that lie along the ecliptic in our sky

112) Which of the following statements does *not* use the term *angular size* or *angular distance* correctly? 112) _____
A) The angular size of the Sun is about the same as that of the Moon.
B) The angular distance between those two bright stars in the sky is about 2 meters.
C) You can use your outstretched hand against the sky to estimate angular sizes and angular distances.
D) The angular distance between those two houses in the distance is 30 degrees.

113) Which of the following correctly describes the *meridian* in your local sky? 113) _____

A) a half-circle extending from your horizon due north, through your zenith, to your horizon due south
B) the point directly over your head
C) a half-circle extending from your horizon due east, through your zenith, to your horizon due west
D) a half-circle extending from your horizon due east, through the north celestial pole, to your horizon due west

114) The point directly over your head is called _____. 114) _____

A) the north celestial pole
B) the zenith
C) the North Star
D) the meridian

115) Stars that are visible in the local sky on any clear night of the year, at any time of the night, are called _____. 115) _____

A) bright
B) seasonal
C) celestial
D) circumpolar

116) We describe a location on *Earth's surface* by stating its _____. 116) _____

A) meridian and longitude
B) altitude and direction (or azimuth)
C) latitude and longitude
D) latitude and direction

117) If you are located in the Northern Hemisphere, which of the following correctly describes a relationship between the sky and your location? 117) _____

A) The altitude of the celestial equator equals your latitude.
B) The altitude of the north celestial pole equals your longitude.
C) The altitude of the north celestial pole equals your latitude.
D) The longitude of the north celestial pole is circumpolar, and therefore crosses your zenith at the meridian.

118) Which of the following best describes why we have seasons on Earth? 118) _____

A) The varying speed of Earth in its orbit around the Sun gives us summer when we are moving fastest and winter when we are moving slowest.
B) The tilt of Earth's axis causes different portions of the Earth to receive more or less direct sunlight at different times of year.
C) Earth's elliptical orbit means we are closer to the Sun and therefore receive more intense sunlight at some times of year than at others.
D) The tilt of Earth's axis causes the northern hemisphere to be closer to the Sun than the southern hemisphere in summer, and vice versa in winter.

119) Each choice below describes how a few astronomical phenomena are related to time periods. Which list is entirely correct? (Careful: some lists are partially correct.) 119) _____

A) Earth's rotation defines a day.
The cycle of the Moon's phases takes about a week.
Earth's orbit defines a year.
Earth's cycle of axis precession defines a month.

B) Earth's rotation defines a day.
The Sun's rotation defines a week.
The Moon's rotation defines a month.
Earth's orbit defines a year.

C) Earth's rotation defines a day.
The saros cycle of eclipses defines a month.
Earth's orbit defines a year.
Earth's cycle of axis precession takes 26,000 years.

D) Earth's rotation defines a day.
The cycle of the Moon's phases takes about a month.
Earth's orbit defines a year.
Earth's cycle of axis precession takes 26,000 years.

120) If we have a new moon today, when we will have the next full moon? 120) _____

A) in about 2 weeks
B) in about 1 month
C) in about 1 week
D) in about 6 months

121) We cannot see a new moon in our sky because _____. 121) _____

A) it is above the horizon during the daytime
B) a new moon is quite near the Sun in the sky
C) no sunlight is illuminating the Moon
D) it is obscured by Earth's shadow

122) Lunar eclipses can occur only during a _____. 122) _____

A) third quarter moon
B) full moon
C) new moon
D) first quarter moon

123) What is the *saros cycle*? 123) _____

A) the annual cycle of the seasons
B) the roughly 18-year cycle over which the pattern of eclipses repeats
C) the roughly one-month cycle of lunar phases in the sky
D) the 26,000-year cycle of the Earth's precession

124) During the time that a planet is in its period of *apparent retrograde motion*, _____. 124) _____

A) the planet appears to rise in the west and set in the east, rather than the usual rising in the east and setting in the west
B) the planet is getting closer to the Sun in its orbit
C) over many days or weeks, the planet moves westward relative to the stars, rather than the usual eastward relative to the stars
D) the planet moves backwards (clockwise as viewed from above Earth's north pole) in its orbit of the Sun

125) What is *stellar parallax*? 125) _____

A) It is the slight back-and-forth shifting of star positions that occurs as we view the stars from different positions in Earth's orbit of the Sun.
B) It is the daily rise and set of the stars.
C) It is the change in the set of constellations that we see at different times of year in the evening sky.
D) It describes the fact that stars are actually moving relative to one another, even though to our eyes the stars appear fixed in the constellations.

126) Which of the following statements about the celestial sphere is *not* true? 126) _____

A) When we look in the sky, the stars all appear to be located on the celestial sphere.
B) The celestial sphere does not exist physically.
C) The Earth is placed at the center of the celestial sphere.
D) The "celestial sphere" is another name for our universe.

127) The Andromeda Galaxy is faintly visible to the naked eye in the constellation Andromeda. Suppose instead it were located in the same direction in space as the center of the Milky Way Galaxy (but still at its current distance). How would it appear to the eye in that case? 127) _____

A) It would look about the same, but it would be harder to pick out because its cloud-like appearance would make it blend in with the cloud-like appearance of the Milky Way in our sky.
B) It would be much brighter because it would be illuminated by the many stars in the center of our galaxy.
C) We could not see it at all.
D) It would look about the same, but would be in the constellation Sagittarius instead of Andromeda.

128) An angle of 1 arcsecond is _____. 128) _____

A) about the width of a finger held at arm's length
B) about the width of your fist held at arm's length
C) slightly more than the width of a basketball held at arm's length
D) less than the thickness of a human hair held at arm's length

129) When traveling north from the United States into Canada, you'll see the North Star (Polaris) getting _____. 129) _____

A) dimmer
B) higher in the sky
C) brighter
D) lower in the sky

130) Suppose you use the Southern Cross to determine that the south celestial pole appears 40 degrees above your horizon. Then you must be located at _____. 130) _____

A) latitude 40 degrees south
B) latitude 40 degrees north
C) longitude 40 degrees
D) latitude 50 degrees south

131) Suppose you are facing north and you see the Big Dipper close to your northern horizon, with Polaris (and the Little Dipper) above it. Where will you see the Big Dipper in six hours? 131) _____

A) still in the same place, below Polaris
B) directly above Polaris
C) to the right of Polaris; that is, 90 degrees counterclockwise from its current position
D) to the left of Polaris; that is, 90 degrees clockwise from its current position

132) In any particular place on Earth, certain constellations are visible in the evening only at certain times of the year because _____. 132) _____
A) some constellations are circumpolar
B) our evening view of space depends on where Earth is located in its orbit around the Sun
C) on any particular night, we can only see stars that are directly opposite (180 degrees away from) the Sun in the sky
D) during some times of year, some constellations drop below the southern horizon

133) The Sun's path, as viewed from the equator, is highest in the sky on _____. 133) _____
A) the spring and fall equinoxes
B) the winter solstice
C) the summer solstice
D) the day when Earth is closest to the Sun

134) Suppose Earth's axis tilt was significantly greater than its current 23.5 degrees, but Earth's rotation period and orbital period were unchanged. Which statement below would *not* be true? 134) _____
A) Polaris would not be our North star.
B) Summers and winters would be more severe (for example, hotter and colder, respectively) than they are now.
C) The length of each season (for example, the number of days from the summer solstice to the fall equinox) would be significantly longer than it is now.
D) The region of Earth where the Sun does not rise on the winter solstice would be larger (extending farther south) than it is now.

135) If our year were twice as long (that is, if Earth took twice as many days to complete each orbit around the Sun), but Earth's rotation period and axis tilt were unchanged, then _____. 135) _____
A) stars would take twice as long to rise and set
B) the Earth would not have seasons
C) the cycle of precession would take 13,000 years instead of 26,000 years
D) the four seasons would each be twice as long as they are now

136) How does Earth's varying distance from the Sun affect our seasons? 136) _____
A) It doesn't—Earth's orbital distance plays no significant role in the seasons.
B) It causes the seasons to be more extreme than they would be if the Earth's distance from the Sun were always the same.
C) It is responsible for the fact that the seasons are opposite in the Northern and Southern hemispheres.
D) It makes summer warmer in the Northern Hemisphere than in the Southern Hemisphere.

137) Suppose you live in the United States and you see a crescent moon in your evening sky tonight. What will a friend in South America see tonight? 137) _____
A) Your friend will see a gibbous moon.
B) Your friend won't see the Moon tonight, because it is up only in the morning.
C) Your friend will also see a crescent moon.
D) Your friend will see a first quarter moon.

138) Suppose it is full moon. What phase of Earth would someone on the Moon see at this time? 138) _____
A) first quarter Earth
B) new Earth
C) full Earth
D) Earth does not go through phases as seen from the Moon.

139) It's 6 a.m. and the Moon is at its highest point in your sky (crossing the meridian). What is the Moon's phase? 139) _____

A) third quarter B) new C) first quarter D) full

140) You observe a full moon rising at sunset. What will you see at midnight? 140) _____

A) a first quarter moon
B) a third quarter moon
C) a waning gibbous moon
D) a full moon high in the sky

141) All the following statements are true. Which one explains the reason that there is *not* a solar eclipse at every new moon? 141) _____

A) The Moon is only about 1/4 as large as Earth in diameter.
B) The nodes of the moon's orbit precess with an 18-year period.
C) The Moon goes through a complete cycle of phases about every 29 1/2 days.
D) The orbital plane of the Moon is tilted slightly (by about 5 degrees) to the ecliptic plane.

142) For most of history, the lack of observable stellar parallax was interpreted to mean that _____. 142) _____

A) Galileo's theories of the universe were essentially correct
B) stars must all lie at the same distance from Earth, on the celestial sphere
C) stars were too far away for parallax to be measured with available technology
D) Earth is stationary at the center of the universe

143) During the period each year when we see Mars undergoing apparent retrograde motion in our sky, what is really going on in space? 143) _____

A) Earth and Mars are getting closer together.
B) Mars is moving around the Sun in the opposite direction from which Earth is moving around the Sun.
C) Earth and Mars are on opposite sides of the Sun.
D) Earth is catching up with and passing by Mars in their respective orbits.

144) Suppose you see a photo showing Jupiter half in sunlight and half in shadow (that is, a *first quarter* Jupiter). This photo might have been taken by _____. 144) _____

A) the Hubble Space Telescope (which orbits Earth)
B) the Galileo spacecraft that orbited Jupiter in the 1990s
C) the Keck telescope on Mauna Kea, Hawaii
D) the Arecibo radio telescope in Puerto Rico

145) RXJ1800, a galaxy, lies very near in the sky to the bright star Vega. What is the best explanation for them appearing close together? 145) _____

A) Vega must have recently formed in RXJ1800 and been ejected.
B) They coincidentally lie along the same line of sight.
C) Their random motions have caused RXJ1800 and Vega to drift to within a few light-years of each other.
D) Vega orbits the center of mass of RXJ1800.

Answer Key
Testname: UNTITLED30

1) B
2) A
3) B
4) C
5) D
6) D
7) C
8) A
9) B
10) E
11) C
12) E
13) A
14) A
15) D
16) C
17) E
18) B
19) B
20) B
21) D
22) C
23) C
24) C
25) B
26) E
27) E
28) E
29) E
30) A
31) C
32) C
33) C
34) A
35) C
36) C
37) C
38) B
39) E
40) A
41) A
42) A
43) B
44) B
45) A
46) D
47) TRUE
48) FALSE
49) FALSE
50) FALSE

51) FALSE
52) FALSE
53) FALSE
54) TRUE
55) FALSE
56) TRUE
57) TRUE
58) FALSE
59) FALSE
60) Will vary.
61) Will vary.
62) Will vary.
63) Will vary.
64) C
65) C
66) D
67) A
68) A
69) D
70) B
71) A
72) We would no longer have seasons, because the Sun's light would hit at the same angle all throughout the year, depending only on where you lived. The slight change in distance between Earth and the Sun during the year would not produce much of an effect.
73) This statement does not make sense because the celestial sphere is a concept and not a physical object.
74) This statement does not make sense because we cannot see through the band of light we call the Milky Way to external galaxies; the dark fissure is gas and dust blocking our view.
75) The solar system lies in the outer parts of the thin disk of a spiral galaxy. Thus when we look along the plane of the disk, we see large numbers of stars that, to the naked eye, merge into a band of light. When we look out of the plane of the disk, there are very few stars and the night sky is much darker.
76) This statement does not make sense. The stars aren't really rising and setting, they only appear to rise in the east and set in the west because Earth rotates.
77) Answers will vary with your latitude; latitude = altitude of NCP (or SCP in Southern Hemisphere).
78) Not sensible: The Sun appears only in the constellations of the zodiac-and Ursa Major is not one of these.
79) This statement does not make sense because Jupiter, like all the planets, is always found very close to the ecliptic in the sky. The ecliptic passes through the constellations of the zodiac, so Jupiter can appear to be only in one of the 12 zodiac constellations—and Ursa Major is not one of these.
80) A. Answers will vary with latitude; here is a sample for 40°N: The north celestial pole appears at an altitude of 40°, in the direction due north.
B. Yes, for any location in the Northern Hemisphere; no, for any location in the Southern Hemisphere. Polaris is circumpolar because it never rises or sets in our sky. It makes a daily circle, less than 1° in radius, around the north celestial pole.
C. The meridian is a half-circle that stretches from the due south point on the horizon, through the zenith, to the due north point on the horizon.
D. Answers will vary with latitude; here is a sample answer for 40°N: The celestial equator is a half-circle that stretches from the due east point on the horizon, through an altitude of 50° due south, to the due west point on the horizon.
81) This is true, because at full moon Earth lies between the Sun and the Moon. Thus, an observer on the Moon would be looking at the night side of Earth.
82) During the full moon, it would be daytime and you would see the phase of new Earth.

83) During the new moon, it would be nighttime and you would see the phase of full Earth.
84) Sunset would occur at the Moon's third-quarter phase. You would see Earth in first-quarter phase at this time.
85) Sunrise would occur at the Moon's first-quarter phase. You would see Earth in third-quarter phase at this time.
86) During a lunar eclipse, you would see Earth pass in front of the Sun. It would be completely dark where you were.
87) The Moon shines through reflected light from the Sun and thus it becomes very dark during a lunar eclipse since the Moon lies within Earth's shadow at this time. However, some sunlight still gets through because it is bent (similar to the way a lens works) by Earth's atmosphere. We see the reflection of this faint light and thus the Moon is not completely invisible. (The bending of light is called *refraction* and the effect is strongest at long wavelengths. Thus it is most pronounced for red light and the eclipsed Moon appears dark red.)
88) During a solar eclipse, you would see a small circular shadow traveling across a portion of Earth's surface.
89) If the Moon were twice its actual distance from us, we would no longer be able to see total solar eclipses because the Moon would not be able to completely cover the surface of the Sun; however, we would still see partial and annular eclipses, although the Moon would not block as much of the Sun during these times.
90) This statement does not make sense because the apparent retrograde motion is noticeable only over many nights, not during a single night. (Of course, like all celestial objects, Mars moves from east to west over the course of every night.)
91) B
92) C
93) D
94) C
95) A
96) A
97) E
98) C
99) A
100) B
101) C
102) B
103) A
104) C
105) D
106) B
107) C
108) A
109) C
110) C
111) B
112) B
113) A
114) B
115) D
116) C
117) C
118) B
119) D
120) A
121) B
122) B
123) B
124) C

125) A
126) D
127) C
128) D
129) B
130) A
131) C
132) B
133) A
134) C
135) D
136) A
137) C
138) B
139) A
140) D
141) D
142) D
143) D
144) B
145) B