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

1) Which of the following is smallest?
   A) 1 AU
   B) size of a typical star
   C) 1 light-second
   D) size of a typical planet

2) On the scale of the cosmic calendar, in which the history of the universe is compressed to 1 year, how long has human civilization (i.e., since ancient Egypt) existed?
   A) about a month
   B) a few hours
   C) less than a millionth of a second
   D) a few seconds
   E) about half the year

3) Patterns of stars in constellations hardly change in appearance over times of even a few thousand years. Why?
   A) Stars are fixed and never move.
   B) Although most stars move through the sky, the brightest stars do not, and these are the ones that trace the patterns we see in the constellations.
   C) Stars within a constellation move together as a group, which tends to hide their actual motion and prevent the pattern from changing.
   D) Stars move, but they move very slowly—only a few kilometers in a thousand years.
   E) The stars in our sky actually move rapidly relative to us—thousands of kilometers per hour—but are so far away that it takes a long time for this motion to make a noticeable change in the patterns in the sky.

4) Which scientists played a major role in overturning the ancient idea of an Earth-centered universe, and about when?
   A) Huygens and Newton; about 300 years ago
   B) Copernicus, Kepler, and Galileo; about 400 years ago
   C) Aristotle and Plato; about 2,000 years ago
   D) Aristotle and Copernicus; about 400 years ago
   E) Newton and Einstein; about 100 years ago

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

5) It is possible to see the third-quarter Moon near the western horizon at sunrise.

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

7) If you lived on the Moon, you’d see full Earth when we see new Moon.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

8) Which of the following statements about the celestial sphere is not true?
A) The "celestial sphere" is just another name for our universe.
B) From any location on Earth, we can see only half the celestial sphere at any one time.
C) Earth is placed at the center of the celestial sphere.
D) When we look in the sky, the stars all appear to be located on the celestial sphere.
E) The celestial sphere does not exist physically.

9) What is the **ecliptic**?
A) when the Moon passes in front of the Sun
B) the Sun's apparent path along the celestial sphere
C) the Sun's daily path across the sky
D) the Moon's apparent path along the celestial sphere
E) the constellations commonly used in astrology to predict the future

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

11) Which of the following statements does not use the term **angular size or angular distance** correctly?
A) The angular distance between those two houses in the distance is 30°.
B) The angular size of the Sun is about the same as that of the Moon.
C) The angular size of the Moon is about 1/2 degree.
D) You can use your outstretched hand to estimate angular sizes and angular distances.
E) The angular distance between those two bright stars in the sky is about 2 meters.

12) We describe a position on Earth's surface by stating its
A) altitude and azimuth.
B) meridian and longitude.
C) latitude and direction.
D) latitude and longitude.
E) altitude and direction.

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

14) You are standing on Earth's equator. Which way is Polaris, the North star?
A) directly overhead
B) on the northern horizon
C) 30 degrees up, due West
D) The answer depends on whether it's winter or summer.
E) The answer depends on what time of day (or night) it is.
15) Orion is visible on winter evenings but not summer evenings because of
   A) the location of Earth in its orbit.
   B) baseball on television.
   C) the tilt of Earth’s axis.
   D) interference from the full Moon.
   E) the precession of Earth’s axis.

16) Why is it summer in the Northern Hemisphere when it is winter in the Southern Hemisphere?
   A) The Northern Hemisphere is tilted away from the Sun and receives more indirect sunlight.
   B) The Northern Hemisphere is tilted toward the Sun and receives more direct sunlight.
   C) The Northern Hemisphere is “on top” of Earth and therefore receives more 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.

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

18) Which of the following statements about lunar phases is true?
   A) 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.
   B) It is possible to have two full Moons during January, but not during February.
   C) The time between new Moons is two weeks.
   D) It is possible to have two full Moons during November, but not during December.
   E) The full Moon sometimes rises around midnight.

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

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

21) Which of the following statements about the Moon is true?
   A) The Moon is visible only at night.
   B) The Moon goes through a cycle of phases because it always has the same side facing Earth.
   C) The side of the Moon facing away from Earth is in perpetual darkness.
   D) If you see a full Moon from North America, someone in South America would see a new Moon.
   E) The Moon’s distance from Earth varies during its orbit.
22) All of the following statements are true. Which one explains the reason why there is not a solar eclipse at every new Moon?
   A) The sidereal month is shorter than the lunar month.
   B) The nodes of the Moon’s orbit precess with an 18-year period.
   C) The Moon is the primary cause of tides on Earth.
   D) The orbital plane of the Moon is tilted by about 5° to the ecliptic plane.
   E) The Moon rotates synchronously with its revolution about Earth.

23) What conditions are required for a solar eclipse?
   A) The phase of the Moon must be new, and the Moon’s orbital plane must lie in the ecliptic.
   B) 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.
   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 nodes of the Moon’s orbit must be nearly aligned with Earth and the Sun.
   E) 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.

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

25) We can’t detect stellar parallax with naked-eye observations. Which of the following would make parallax easier to observe?
   A) speeding up Earth's rotational motion
   B) increasing the size of Earth’s orbit
   C) slowing down Earth’s rotational motion
   D) speeding up the precession of Earth's axis
   E) getting away from streetlights

26) Why did Ptolemy have the planets orbiting Earth on “circles upon circles” in his model of the universe?
   A) to explain the fact that planets sometimes appear to move westward, rather than eastward, relative to the stars in our sky
   B) to explain why more distant planets take longer to make a circuit through the constellations of the zodiac
   C) to explain why Venus goes through phases as seen from Earth
   D) to properly account for the varying distances of the planets from Earth
   E) to explain why the Greeks were unable to detect stellar parallax

27) He discovered that Jupiter has moons.
   A) Tycho Brahe
   B) Galileo
   C) Aristotle
   D) Ptolemy
   E) Kepler
28) One of the "nails in the coffin" for Earth-centered universe was
   A) eclipses of the Sun.
   B) Galileo's observation of stars in the Milky Way.
   C) Galileo's observations of the moons of Jupiter.
   D) the retrograde motion of the planets.
   E) the phases of the Moon.

29) Which of the following is not one of, nor follows directly from, Kepler's laws?
   A) More distant planets move at slower speeds.
   B) The orbit of each planet about the Sun is an ellipse with the Sun at one focus.
   C) The force of attraction between any two objects decreases with the square of the distance between their centers.
   D) A planet travels faster when it is nearer to the Sun and slower when it is farther from the Sun.
   E) As a planet moves around its orbit, it sweeps out equal areas in equal times.

30) As long as an object is not gaining or losing mass, a net force on the object will cause a change in
   A) speed.
   B) acceleration.
   C) direction.
   D) weight.
   E) velocity.

31) Newton's second law of motion tells us that the net force applied to an object equals its
   A) mass times acceleration.
   B) mass times energy.
   C) energy times acceleration.
   D) momentum times velocity.
   E) mass times velocity.

32) All the following statements are true. Which one follows directly from Kepler's third law?
   A) Venus is larger than Mercury.
   B) Venus has a thicker atmosphere than Mercury.
   C) Venus orbits the Sun at a slower average speed than Mercury.
   D) Venus is more massive than Mercury.

33) If an object's velocity is doubled, its momentum is
   A) doubled.
   B) unchanged.
   C) halved.
   D) dependent on its acceleration.
   E) quadrupled.
34) Which of the following statements correctly describes the law of conservation of energy?
   A) The fact that you can fuse hydrogen into helium to produce energy means that helium can be turned into hydrogen to produce energy.
   B) An object always has the same amount of energy.
   C) Energy can change between many different forms, such as potential, kinetic, and thermal, but it is ultimately destroyed.
   D) The total quantity of energy in the universe never changes.
   E) It is not really possible for an object to gain or lose potential energy, because energy cannot be destroyed.

35) The mass of Jupiter can be calculated by
   A) measuring the orbital speed of one of Jupiter’s moons.
   B) measuring the orbital period and distance of Jupiter’s orbit around the Sun.
   C) knowing the Sun’s mass and measuring the average distance of Jupiter from the Sun.
   D) knowing the Sun’s mass and measuring how Jupiter’s speed changes during its elliptical orbit around the Sun.
   E) measuring the orbital period and distance of one of Jupiter’s moons.

36) Which of the following best describes the origin of ocean tides on Earth?
   A) Tides are caused by the difference in the force of gravity exerted by the Moon across the sphere of the earth.
   B) Tides are caused on the side of Earth nearest the Moon because the Moon’s gravity attracts the water.
   C) Tides are caused by the 23 1/2° tilt of the earth’s rotational axis to the ecliptic plane.
   D) Tides are caused primarily by the gravitational force of the Sun.
   E) The Moon’s gravity pulls harder on water than on land, because water is less dense than rock.

37) At which lunar phase(s) are tides least pronounced (e.g., the lowest high tides)?
   A) new Moon
   B) first quarter
   C) full Moon
   D) both new and full Moons
   E) both first and third quarters

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

38) Speed and velocity are the same thing.
39) When energy is converted from one form to another, a tiny amount is inevitably lost.
40) There is no gravity in space.
41) The Moon is constantly falling toward Earth.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

42) The \textit{wavelength} of a wave is
   \begin{enumerate} \setlength\itemsep{-0.1em} \item A) the distance between where the wave is emitted and where it is absorbed. \item B) how strong the wave is. \item C) equal to the speed of the wave times the wave's frequency. \item D) the distance between a peak of the wave and the next trough. \item E) the distance between two adjacent peaks of the wave. \end{enumerate}

43) How can an electron in an atom lose energy to go from a higher energy level to a lower energy level?
   \begin{enumerate} \setlength\itemsep{-0.1em} \item A) It absorbs a photon equal in energy to its own energy drop. \item B) It exchanges gravitational potential energy for kinetic energy. \item C) It releases a photon equal in energy to its own energy drop. \item D) It loses kinetic energy. \item E) It loses gravitational potential energy. \end{enumerate}

44) Which of the following statements about thermal radiation is \textit{always true}?
   \begin{enumerate} \setlength\itemsep{-0.1em} \item A) A hot object emits more total radiation than a cool object. \item B) A hot object emits less total radiation than a cool object. \item C) A hot object emits more radio waves than a cool object. \item D) A hot object emits more total radiation per unit surface area than a cool object. \item E) A hot object emits more X rays than a cool object. \end{enumerate}

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

45) The shorter the wavelength of light, the higher its frequency. \hspace{1cm} 45)

46) Lines of a particular element appear at the same wavelength in both emission and absorption line spectra. \hspace{1cm} 46)

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

47) Planet Jupiter has an angular diameter of 31.2 arcseconds. The distance between Jupiter and the Earth is measured to be 9.43 x 10^8 km. What is the diameter of Jupiter in kilometers?
   \begin{enumerate} \setlength\itemsep{-0.1em} \item A) 1.43 \times 10^5 km \item B) 2.03 \times 10^5 km \item C) 1.05 \times 10^4 km \item D) 3.18 \times 10^5 km \item E) 1.43 \times 10^4 km \end{enumerate}

48) The average distance of Mars from the Sun is 1.5 AU. What is the average distance of Mars to the Sun in km?
   \begin{enumerate} \setlength\itemsep{-0.1em} \item A) 2.25 \times 10^{11} km \item B) 1.5 \times 10^8 km \item C) 1.0 \times 10^9 km \item D) 2.25 \times 10^8 km \item E) 1.05 \times 10^8 km \end{enumerate}
49) One light-hour is the distance that light travels in one hour. How far is it, in km?
   A) 1.08 billion km
   B) 3 x 10^5 km
   C) 9.46 trillion km
   D) 18 million km
   E) 100 million km

50) The planet Neptune has a mass of 1 x 10^{26} kg and a radius of 24,500 km. If you stand on the surface of Neptune and drop a ball, what is its acceleration?
   A) 9.8 m/s^2
   B) 11 m/s^2
   C) 1.1 m/s^2
   D) 98 m/s^2
   E) 110 m/s^2

51) Your neighbor put in a porch light that emits 100 Watts (Joules per second). Your neighbor’s house is 10 m away from your house. What is the flux (apparent brightness) you measure from your neighbor’s porch light?
   A) 1 J/ (m^2s)
   B) 0.8 J/ (m^2s)
   C) 0.08 J
   D) 0.08 J/ (m^2s)
   E) 0.8 J

52) The planet Jupiter has a moon, Calisto, that orbits Jupiter every 16.69 days at an average distance of 1.9 billion meters. What is the mass of Jupiter?
   A) 1.4 x 10^{37} kg
   B) 2.0 x 10^{27} kg
   C) 5.4 x 10^{8} kg
   D) 1.3 x 10^{17} kg
   E) 2.0 x 10^{28} kg

53) A gamma ray photon has a wavelength of 10^{-12} m. How much energy does it carry?
   A) 18 x 10^{-34} J
   B) 1.9 x 10^{-30} J
   C) 1.9 x 10^{-13} J/s^2
   D) 1.9 x 10^{-13} J
   E) 3 x 10^{20} J
54) Mars has an average orbital distance of 1.5 AU, and a mass of 0.1 times that of Earth. Neptune, on the other hand, orbits the Sun at an average orbital distance of about 30 AU and a mass that is 17 times that of Earth. How do the gravitational force that each of these planets feels compare?

A) The gravitational force on Mars is about 2 times stronger than Neptune's
B) The gravitational force on Mars is about 2 times weaker than Neptune's
C) The gravitational force on Mars is 0.1 times stronger than Neptune's
D) The gravitational force on Mars is 0.1 times weaker than Neptune's
E) There is not enough information to solve this problem

55) A blackbody is emitting a thermal radiation spectrum that has its maximum at 550 nm. What is its temperature?

A) $5.2 \times 10^3$ K
B) $5.2 \times 10^2$ K
C) $5.2 \times 10^{-3}$ K
D) $5.2 \times 10^6$ K
E) $5.2 \times 10^6$ K
Answer Key
Testname: SAMPLE-QUESTIONS

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

50) B
51) D
52) B
53) D
54) A
55) A