

# SPACE SCIENCE

- Evidence that the universe is expanding is best provided by the
  - red shift in the light from distant galaxies
  - change in the swing direction of a Foucault pendulum on Earth
  - parallelism of Earth's axis in orbit
  - spiral shape of the Milky Way Galaxy
- In Northern hemisphere, summer is warmer than winter because in summer Northern hemisphere has
  - fewer hours of daylight and receives low angle insolation
  - fewer hours of daylight and receives high angle insolation
  - more hours of daylight and receives low-angle insolation
  - more hours of daylight and receives high angle insolation
- Which object forms by the contraction of a large sphere of gases causing the nuclear fusion of lighter elements into heavier elements?
  - comet
  - star
  - planet
  - moon
- Which statement best describes the position of the Sun at sunrise and sunset as seen by an observer in Northern hemisphere on June 21?
  - The Sun rises north of due east and sets north of due west.
  - The Sun rises south of due east and sets south of due west.
  - The Sun rises north of due east and sets south of due west.
  - None of these
- As viewed from Earth, most stars appear to move across the sky each night because
  - Earth revolves around the Sun
  - Earth rotates on its axis
  - Stars orbit around Earth
  - Stars revolve around the center of the galaxy
- The explosion associated with the Big Bang theory and the formation of the universe is inferred to have occurred how many billion years ago?
  - less than 1
  - 4.6
  - 2.5
  - over 10
- The best evidence that Earth spins on its axis is the motion of
  - tectonic plates
  - Polaris*
  - a wind vane
  - a Foucault pendulum
- When viewed from Earth, the light from very distant galaxies shows a red shift. This is evidence that these distant galaxies are
  - revolving around the Sun
  - revolving around the Milky Way
  - moving away from Earth
  - moving toward Earth
- Why is evidence of asteroids striking Earth so difficult to find?
  - Asteroids are made mostly of frozen water and gases and are vaporized on impact.
  - Asteroids are not large enough to leave impact craters.
  - Asteroids do not travel fast enough to create impact craters.
  - Weathering, erosion, and deposition on Earth have destroyed or buried most impact craters.
- The average temperature at Earth's equator is higher than the average temperature at Earth's South Pole because the South Pole
  - receives less intense insolation
  - receives more infrared radiation
  - has less land area
  - has more cloud cover

11. Who had propounded the planetary laws?
- (1) Newton
  - (2) Kepler
  - (3) Galileo
  - (4) Copernicus
12. The device employed to measure the diameters of stars and our galaxy (Milky Way) is called:
- (1) Photometer
  - (2) Barometer
  - (3) Viscometer
  - (4) Interferometer
13. Who first suggested the ‘passing star hypothesis’ to describe the origin of the solar system?
- (1) Rene Descartes
  - (2) Louis de Buffon
  - (3) Issac Newton
  - (4) Albert Einstein
14. Paris based minor planet centre of International Astronomical Union (IAU) has given a new name to the planet Pluto and it is
- (1) 134340
  - (2) 238380
  - (3) Iris
  - (4) Nixe
15. The new name of the celestial body Xena-2003 UB 313 given by IAU is
- (1) Sires
  - (2) Iris
  - (3) Grabrili
  - (4) Daysomia
16. Hubble’s “constant” is constant in
- (1) time
  - (2) space
  - (3) space and time
  - (4) our Galaxy but different in others
17. Which of the following types of galaxies are reddest in color?
- (1) Spirals
  - (2) Ellipticals
  - (3) Lenticulars
  - (4) Irregulars
18. Recall that *Hubble’s law* is written  $v = H_0 d$ , where  $v$  is the recession velocity of a galaxy located a distance  $d$  away from us, and  $H_0$  is *Hubble’s constant*. Suppose  $H_0 = 65$  km/s/Mpc. How fast would a galaxy located 500 megaparsecs distant be receding from us?
- (1) 65 km/s
  - (2) 65 Mpc/s
  - (3) 32,500 km/s
  - (4) 9 km/s
19. Cosmological redshift is the result of
- (1) the high speeds at which galaxies move within clusters.
  - (2) the expansion of the universe.
  - (3) very old, red stars in distant galaxies.
  - (4) supermassive black holes.
20. You observe the peak brightnesses of two *white dwarf supernovae*. Supernova A is only 1/4 as bright as Supernova B. What can you say about their relative distances?
- (1) Supernova A is twice as far away as Supernova B.
  - (2) Supernova A is 4 times as far away as Supernova B.
  - (3) Supernova B is 4 times as far away as Supernova A.
  - (4) Supernova B is twice as far away as Supernova A.

21. The Sun is currently undergoing *mass loss*. What do we call the physical manifestation of this process?

- (1) Sunspots
- (2) The solar wind
- (3) The Sun's photosphere
- (4) The Sun's chromosphere

22. How did Hubble show that the Andromeda 'nebula' is actually a separate galaxy?

- (1) He recorded the emission spectrum from it.
- (2) He measured the distances to all of its globular clusters.
- (3) He was able to see planets orbiting stars in the Andromeda galaxy.
- (4) He photographed individual stars in it, such as Cepheid variable stars.

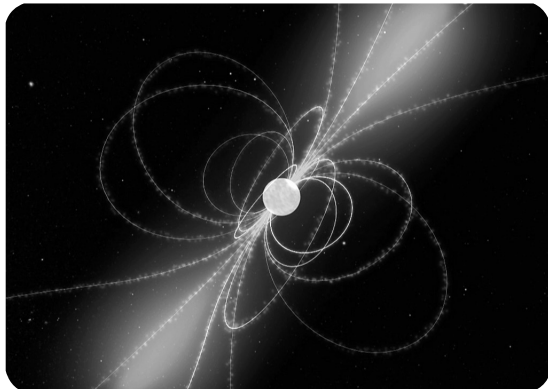
23. If a star with a mass greater than 20 Suns collapses to become a black hole, what might this event look like from Earth?

- (1) A gamma-ray burst.
- (2) It will remain invisible from Earth.
- (3) A normal nova, as opposed to a supernova.
- (4) A region of self-sustaining star formation.

24. In what form is most of the matter in a typical galaxy (or cluster of galaxies)?

- (1) Dark energy
- (2) Young, bluish, high-temperature stars
- (3) Dark matter
- (4) Old, reddish-colored stars

25. What makes an object like this appear as a 'pulsar' when seen from Earth?



(1) It is caught up in the accretion disk around a quasar, causing it to be eclipsed by a large black hole.

(2) Beams of radiation sweep past the Earth as the object rotates.

(3) It is moving rapidly towards the Earth, giving it a large blueshift.

(4) The object grows and shrinks many times per second, thus changing its apparent brightness.

26. If the original object (of which this is a leftover) had been much more massive, so that this remnant weighed several times the Sun's mass, what would have happened here?

(1) A new star would have begun hydrogen fusion.

(2) The object would have slowed its rotation, nearly ceasing to rotate.

(3) A black hole would have formed.

(4) The host galaxy would have developed a new spiral arm.

27. Imagine you could somehow add a great deal of hydrogen gas to the object at this nebula's centre. If you added enough hydrogen to suddenly increase its mass well above 1.4 solar masses, what would happen?



(1) The nebula would contract back onto the object, forming a main-sequence star.

(2) A globular star cluster would form.

(3) The expansion of the universe in the host galaxy would suddenly reverse.

(4) It would explode as a type Ia supernova.

28. A planet is moving in an elliptical orbit. If T, V, E and L are respectively the kinetic energy, potential energy, total energy and the magnitude of the angular momentum of the planet then the true statement out of the following is:
- (1) T is conserved
  - (2) V is always positive
  - (3) E is always negative
  - (4) L is conserved but the direction vector  $\vec{L}$  continuously changes
29. If the mass of a ball is 5 kg on earth, then what would be its mass on Jupiter?
- (1) 5 kg
  - (2) 5000 kg
  - (3) 40000 kg
  - (4) 50 kg
30. The time interval between two successive occurrences of a specific type of alignment of a planet (or the moon) with the sun and the earth is referred to as:
- (1) a conjunction
  - (2) an opposition
  - (3) a sidereal period
  - (4) a synodic period
31. Of the following four times, which one best represents the time it takes energy generated in the core of the sun to reach the surface of the sun and be radiated?
- (1) Three minutes
  - (2) Thirty days
  - (3) One thousand years
  - (4) One million years
32. What gas is the main component of the atmosphere of Mars?
- (1) Nitrogen
  - (2) Carbon dioxide
  - (3) Sulphur dioxide
  - (4) All of these
33. During the solar system formation, where did iron and ices of volatiles condense, respectively?
- (1) Iron and volatiles both in the inner zone
  - (2) Iron and volatiles both in the outer zone
  - (3) Iron in the inner zone, volatiles in the outer zone
  - (4) Iron in the outer zone, volatiles in the inner zone
34. Big Bang was an explosion that occurred
- (1) 10 Billion years ago
  - (2) 15 Billion years ago
  - (3) 20 Billion years ago
  - (4) 25 Billion years ago
35. Light from the star, Alpha Centauri, which is nearest to the earth after the sun, reaches the earth in
- (1) 4.2 seconds
  - (2) 42 seconds
  - (3) 4.2 years
  - (4) 42 years
36. Which of the following is true of the Roche Limit?
- (1) Moons are located inside it, rings are located outside.
  - (2) Rings are located inside it, moons are located outside.
  - (3) Only applies to the gas giant planets.
  - (4) Defines the distance at which asteroids transition from stony and metal-rich to black and carbon-rich.
37. Which of the following is not a part of a comet?
- (1) Nucleus
  - (2) Coma
  - (3) Tail
  - (4) Stream
38. Contrary to popular belief, a comet actually has how many tails?
- (1) 0
  - (2) 1
  - (3) 2
  - (4) 3
39. Astronomers are interested in comets primarily because
- (1) they tell us about conditions in the solar nebula from which planets formed.
  - (2) a collision with one would pose a major threat to continued life on the Earth.
  - (3) they tell us about conditions in interstellar space.
  - (4) astronomers are not interested in comets.
40. So far, the most successful technique for detecting extrasolar planets has been
- (1) measuring the doppler shift of a star
  - (2) direct imaging of the planet with a telescope
  - (3) no extrasolar planets have been detected
  - (4) None of these

# INTERACTIVE SECTION

41. Which of the following men wrote the book “On the Revolutions of the Heavenly Spheres”?
- (1) Kepler
  - (2) Euclid
  - (3) Copernicus
  - (4) Newton
42. The two most common elements in the solar system are
- (1) hydrogen and helium
  - (2) hydrogen and oxygen
  - (3) helium and nitrogen
  - (4) helium and oxygen
43. What is the outermost layer of the sun?
- (1) Core
  - (2) Corona
  - (3) Photosphere
  - (4) Chromosphere
44. Sunspots appear dark because they are
- (1) slightly cooler than the surrounding photosphere
  - (2) slightly hotter than the surrounding photosphere
  - (3) a different composition than the rest of the photosphere
  - (4) they do not appear any darker
45. The Milky Way galaxy is best described as
- (1) a type of solar system
  - (2) a constellation visible to everyone on Earth
  - (3) a region in space between the orbits of Mars and Jupiter
  - (4) a spiral-shaped formation composed of billions of stars
46. Compared to the average density of the terrestrial planets (Mercury, Venus, Earth, and Mars), the average density of the Jovian planets (Jupiter, Saturn, Uranus, and Neptune) is
- (1) less
  - (2) greater
  - (3) the same
  - (4) none of these
47. If a star is said to be in hydrostatic equilibrium, it is not contracting because
- (1) the ratio of H to He is equal
  - (2) its temperature is too low
  - (3) its internal pressure balances its gravity
  - (4) it is too dense to contract further
48. All four of the outer planets have
- (1) rings
  - (2) solid surface
  - (3) much smaller than inner planets
  - (4) all of the above
49. Which best characterizes the order of stages in the Moon’s history?
- (1) Cratering, differentiation, slow surface evolution, flooding
  - (2) Differentiation, cratering, flooding, slow surface evolution
  - (3) Cratering, differentiation, flooding, slow surface evolution
  - (4) Flooding, differentiation, cratering, slow surface evolution
50. Which stage of planet evolution is dominated by micrometeorites on Mercury?
- (1) Slow surface evolution
  - (2) Cratering
  - (3) Differentiation
  - (4) Flooding
51. For which of the following do magnetic fields not play an important role?
- (1) Coronae on Venus
  - (2) Sunspots
  - (3) Solar corona
  - (4) Earth’s auroras

52. The solar corona is
- (1) hotter than the solar photosphere
  - (2) denser than the solar photosphere
  - (3) denser than the solar interior
  - (4) the primary source of the sun's energy
53. Why is the average crater size larger on Venus than on our moon?
- (1) The moon's surface is younger.
  - (2) Venus has volcanos.
  - (3) Venus has a thicker atmosphere.
  - (4) Water on Venus erodes small craters.
54. Gravity is important to which of the following stages of Earth's evolution?
- (1) Cratering
  - (2) Differentiation
  - (3) Slow surface evolution
  - (4) All of the above
55. An astronomer discovers a new planet in the Solar System. She then observes a small moon in circular orbit around the new planet. She measures the moon's distance from the planet and the speed of the moon in its orbit. What can she determine from this information?
- (1) The mass of the planet.
  - (2) The mass of the moon.
  - (3) Both the planet mass and the moon mass.
  - (4) The density of the moon.
56. In comparing Venus with Earth, we find
- (1) Venus has a negligible amount of CO<sub>2</sub> in the atmosphere compared to Earth
  - (2) Both have liquid water oceans
  - (3) Venus shows no evidence for plate tectonics, consistent with a more buoyant pliable crust
  - (4) Composite volcanos are common on both planets
57. Sinuous rilles are
- (1) lava channels near maria on the moon
  - (2) water channels on Mars
  - (3) lobate scarps on Mercury
  - (4) bright loops in the solar corona seen during a solar eclipse
58. Using the principles of planet formation, what is the expected order from low density to high density?
- (1) Jupiter, Mercury, Venus, Mars
  - (2) Mercury, Venus, Mars, Jupiter
  - (3) Mars, Jupiter, Venus, Mercury
  - (4) Jupiter, Mars, Venus, Mercury
59. Earth's atmosphere \_\_\_\_\_ than Mars' atmosphere.
- (1) is thinner
  - (2) is thicker
  - (3) is redder
  - (4) has a higher fraction of carbon dioxide
60. Why is Mars' moon Deimos covered with more meteoritic debris than its other moon Phobos?
- (1) Because Deimos is farther from Mars.
  - (2) Because Deimos has a smaller escape velocity.
  - (3) Because Deimos is not spherical.
  - (4) Because Deimos orbits Mars in the prograde direction.



**END OF THE EXAM**