

1. Most primitive ideas about the universe pictured
 - A. the Moon as going around the Sun.
 - B. the Earth and sky as being roughly the same size.
 - C. the Sun as the center of the universe.
 - D. the creation as starting with a huge explosion.
 - E. the stars as distant suns.

2. Most Greek astronomers believed that the Earth is immobile because they did not observe
 - A. retrograde motion of the planets.
 - B. parallaxes for the stars.
 - C. eclipses of the Sun.
 - D. stellar motion.
 - E. All of the other answers are correct.

3. In the ancient geocentric view of the universe, the Earth was surrounded by a celestial sphere that
 - A. took one year to rotate around the Earth.
 - B. rotated from west to east each day.
 - C. was thousands of times larger than the Earth.
 - D. never moved.
 - E. rotated from east to west each day.

4. On the assumption that the Earth is spherical, Eratosthenes estimated the Earth's circumference from measurements made at Alexandria and Syene that depend upon
 - A. the distance to the Sun.
 - B. the apparent size of the Sun.
 - C. the brightness of the Sun.
 - D. the direction of the Sun.

5. The difference in the lengths of shadows simultaneously cast by identical sticks placed vertically in the ground at two different points on a meridian indicates that
 - A. the Earth is spherical.
 - B. the Moon is spherical.
 - C. the Sun is spherical.
 - D. the Earth is not flat.

6. In the Copernican theory, day and night are accounted for by
 - A. the rotation of the Sun.
 - B. the rotation of the Earth.
 - C. the revolution of the Sun about the Earth.
 - D. the rotation of the celestial sphere.
 - E. the revolution of the Earth about the Sun.

7. The Copernican universe has in order of increasing distance from the sun
 - A. Mercury, Venus, Mars, Earth, Jupiter, Saturn.
 - B. Earth, Venus, Mars, Mercury, Saturn, Jupiter.

- C. Mercury, Venus, Earth, Mars, Jupiter, Saturn.
 - D. Venus, Mercury, Earth, Saturn, Mars, Jupiter.
8. If Venus is seen in the west after the Sun sets, next morning it will
- A. Venus is never in the west after sunset.
 - B. rise before the Sun.
 - C. appear to have a considerably different phase.
 - D. go behind the Sun.
 - E. rise after the Sun rises.
9. Kepler's third law states that the square of the orbital period of a planet is proportional to
- A. the orbital semimajor axis.
 - B. its mass squared.
 - C. its density squared.
 - D. the reciprocal of its orbital semimajor axis.
 - E. its orbital semimajor axis cubed.
10. Galileo's studies of moving objects led to the idea that a moving object
- A. comes to rest only if a force stops it.
 - B. is subject to the Universal Law of Gravity.
 - C. will go faster the heavier it is.
 - D. will seek its natural state of rest.
 - E. requires a force to keep it moving.
11. Galileo demonstrated that when a heavy and a light body are dropped at the same instant, and the objects are such that the effect of air resistance on each object is equal,
- A. they fall at rates proportional to their weights.
 - B. they fall exactly at the same rate.
 - C. they behave exactly as Aristotle predicted.
 - D. the lighter one falls faster.
12. Newton's Second Law of Motion showed that the acceleration of a body depends on
- A. its velocity and density.
 - B. its mass and the force on it.
 - C. its mass and velocity.
 - D. its velocity and the force on it.
 - E. its velocity and the amount of friction.
13. Newton's law of gravitation states that the attractive force between any two masses in space is in proportion to the product of the (1)_____ and in inverse proportion to the square of the (2)_____.
- A. (1) distances between them; (2) masses
 - B. (1) masses; (2) distance between them
 - C. (1) reciprocal distances between them; (2) masses
 - D. (1) inverse masses; (2) distance between them
14. Which planets have mainly carbon dioxide (CO₂) for an atmosphere?
- A. Mars and Jupiter
 - B. Venus and Mars

- C. Venus, Earth, and Mars
 - D. Jupiter and Saturn
 - E. Venus, Mars, and Saturn
15. Where is all the carbon dioxide which should be present in the Earth's atmosphere?
- A. rocks
 - B. Earth's ice caps
 - C. air
 - D. gone into space
 - E. oceans
16. The atmospheric pressure on the surface of Venus is about _____ times that of Earth.
- A. 0.9
 - B. 1000
 - C. 100
 - D. 0.01
 - E. 8.9
17. The air pressure at the Viking landing sites on Mars was about _____ percent of the Earth's normal pressure.
- A. 100
 - B. 10
 - C. 1
 - D. 1000
 - E. .1
18. We believe that at one time water flowed on Mars because of observations of
- A. features which look like dried-up river beds.
 - B. erosion on rocks photographed by Viking.
 - C. sedimentary rock near Mars' equator.
 - D. polar ice caps.
 - E. fossilized stern-wheeler paddle steamers.
19. On which objects in the solar system have volcanos been observed actually erupting?
- A. Mercury, Earth, and Mars
 - B. Earth
 - C. Moon, Earth, Mars, and Jupiter
 - D. Earth and Io
 - E. Earth, Mars, and Io
20. The interior of Jupiter principally consists of
- A. gaseous hydrogen, rock and an iron core.
 - B. hydrogen and helium in gaseous form.
 - C. hydrogen and helium in gaseous form.
 - D. gaseous and liquid hydrogen and an icy core.
 - E. methane, ammonia, and hydrogen.
21. William Herschel, while mapping the sky in 1781, accidentally discovered
- A. Pluto
 - B. Mars
 - C. Neptune
 - D. Saturn

- E. Uranus
22. The first person known to have looked at the heavens through a telescope was
- A. Newton
 - B. Galileo
 - C. Ptolemy
 - D. Tycho
 - E. Kepler
23. One effect of the Earth's tides is to
- A. slowly increase the length of our day.
 - B. make the Earth's axis precess with a 26,000 year period.
 - C. change the length of the year.
 - D. pull the Moon closer to the Earth.
24. Eclipses do not occur every month because the
- A. Sun's angular size is slightly larger than the moons.
 - B. Earth's shadow varies in size.
 - C. Moon's shadow varies in size.
 - D. Moon's orbit is inclined to the ecliptic.
25. The largest valley known in the solar system was discovered by Mariner 9 on
- A. a satellite of Saturn.
 - B. Mercury
 - C. a satellite of Jupiter.
 - D. Venus
 - E. Mars
26. The Great Red Spot on Jupiter apparently is
- A. a long-lasting cyclonic system in the clouds.
 - B. an updraft produced by winds hitting mountains.
 - C. a result of a Moon pulling on the magnetic field.
 - D. an illusion caused by the atmosphere acting like a lens.
 - E. a hot area produced by falling matter from space.
27. The diameters of most observed asteroids are
- A. a mile or so.
 - B. 100-500 miles.
 - C. 50-100 miles.
 - D. several hundred miles.
 - E. over 1000 miles.
28. The period of Halley's Comet is (in years) about
- A. 145
 - B. 76
 - C. 93
 - D. 35
 - E. 245
29. Most meteorites come from
- A. outside our solar system.
 - B. asteroids
 - C. comets
 - D. material ejected from the Moon.
 - E. None of the other answers listed here is correct.

30. A faint glow, concentrated along the ecliptic and sometimes seen in the west as darkness falls or in the east just before it gets light, is known as the
- A. Zodiacal light
 - B. ecliptic glow
 - C. ecliptic light
 - D. Milky Way
 - E. asteroidal glow
31. Which of the following lists orders the regions of the electromagnetic spectrum from longest wavelength to shortest wavelength?
- A. x-ray, radio, infrared, visible, ultraviolet, gamma-ray.
 - B. radio, infrared, visible, ultraviolet, x-ray, gamma-ray.
 - C. infrared, visible, radio, ultraviolet, x-ray, gamma-ray.
 - D. gamma-ray, x-ray, ultraviolet, visible, infrared, radio.
 - E. gamma-ray, x-ray, radio, ultraviolet, visible, infrared.
32. Isaac Newton invented
- A. the refracting telescope.
 - B. the reflecting telescope.
 - C. fig-filled cookies.
 - D. the prism.
33. The electrical charges on the proton and electron are
- A. of equal strength but opposite sign.
 - B. respectively, negative and positive.
 - C. both positive.
 - D. of unequal strength but same sign.
34. Molecules are formed when two or more atoms
- A. share nuclei.
 - B. share electrons.
 - C. exchange nuclei.
35. Which force holds people together?
- A. weak nuclear
 - B. gravity
 - C. strong nuclear
 - D. electromagnetic
36. If you made a movie of an atom absorbing light, and played the movie backwards, it would show an atom
- A. emitting light.
 - B. recombining.
 - C. being ionized.
 - D. violating the laws of physics.
 - E. absorbing light.
37. When an atom emits a photon in a given spectral line, the energy of the photon is determined by
- A. the distance from the atom to the observer.
 - B. the temperature of the atom.
 - C. the energy lost by the electron changing orbits.
 - D. whether the electrons move to a smaller or larger orbit.
 - E. the speed of the atom across the line of sight.

38. Ions are atoms with
- A. no electrons.
 - B. fewer electrons than protons.
 - C. a different number of electrons than protons.
 - D. more electrons than protons.
39. The wavelength at which the maximum energy is radiated from a black body is
- A. inversely proportional to temperature.
 - B. directly proportional to temperature.
 - C. independent of the temperature.
 - D. proportional to the inverse square of temperature.
 - E. directly proportional to the fourth power of temperature.
40. The easiest way to discover the chemical composition of the Sun is to
- A. observe the Doppler shift by means of radar waves.
 - B. measure how bright the Sun appears.
 - C. study the formation of solar flares.
 - D. measure the lines in the Sun's spectrum.
 - E. send a space probe to the solar surface to take a sample.
41. From a star's parallax and brightness, one can find the star's
- A. proper motion.
 - B. spectral type.
 - C. luminosity.
 - D. tangential velocity.
 - E. space velocity.
42. If two stars have the same luminosity, the cooler star will have a
- A. fainter apparent magnitude.
 - B. bluer color.
 - C. larger Doppler shift.
 - D. greater distance.
 - E. larger diameter.
43. The greater the distance of a star, the smaller is its
- A. parallax.
 - B. rotation.
 - C. luminosity.
 - D. temperature.
 - E. period.
44. What force holds an electron in orbit in the hydrogen atom?
- A. A magnetic field.
 - B. The attraction of like electrical charges.
 - C. The gravity of the proton.
 - D. The attraction of opposite electrical charges.
 - E. It needs no force to stay in orbit.
45. The difference between a normal atom and its ion is the fact that the ion
- A. has more static electricity in its nucleus.
 - B. doesn't have the usual number of electrons for that atom.

- C. weighs more than the atom.
 - D. is moving more slowly than a normal atom.
 - E. None of the other answers is correct.
46. If we compare several objects at the same temperature, all glowing because they are hot, the one that emits the most light from each unit area of surface will also
- A. absorb light hitting it most efficiently.
 - B. appear bluest.
 - C. appear faintest.
 - D. appear reddest.
47. The first double stars were discovered by
- A. Herschel
 - B. Galileo
 - C. Newton
 - D. Copernicus
 - E. Bradley
48. The mass-luminosity law for main sequence stars is based on accurate mass determinations for ____ stars.
- A. about ten
 - B. less than one hundred
 - C. several thousand
49. The main sequence is a sequence of surface temperature. What other physical property of a star varies continuously along the main sequence?
- A. mass
 - B. rotational velocity
 - C. chemical composition
 - D. age
 - E. extent of the corona
50. Suppose a star's parallax and brightness have been measured. It is then possible to calculate
- A. the distance and proper motion.
 - B. its temperature.
 - C. the density and luminosity.
 - D. the distance and luminosity.
51. If one star has strong lines of molecules and the second star has no molecular lines but strong hydrogen lines, then the first star must
- A. be cooler.
 - B. be larger.
 - C. be farther away.
 - D. have a fainter absolute magnitude.
 - E. have a bluer color.
52. In an H-R diagram, a star's H is plotted against its R.
- A. False
 - B. True
53. Red supergiants on the H-R diagram are located
- A. on the upper right side.
 - B. in the lower left hand corner.

- C. in the lower right hand corner.
 - D. in the middle.
 - E. on the far upper left side.
54. The Sun is an example of
- A. a long period variable star.
 - B. a typical giant star.
 - C. a common main sequence star.
 - D. on of the intrinsically bright stars.
 - E. a rapidly evolving star.
55. If we take a census of the 37 nearest stars, we find that the Sun is
- A. about average with regard to luminosity.
 - B. one of the least luminous.
 - C. one of the most luminous.
56. The age of the Sun is about
- A. five trillion years.
 - B. five thousand years.
 - C. five billion years.
 - D. five million years.
57. The temperature in the center of the Sun is ____ degrees K.
- A. 15.
 - B. 15 thousand.
 - C. 15 million.
 - D. 15 hundred.
 - E. 15 billion.
58. Northern Lights result from
- A. sunlight shining on the Earth's north polar cap.
 - B. the burning of hydrogen high in our atmosphere.
 - C. lightning discharges high in our atmosphere.
 - D. charged particles from the solar wind hitting the upper atmosphere of the Earth.
 - E. light from flares hitting the Earth's upper atmosphere.
59. A protostar becomes visible due to the energy released by
- A. gravitational expansion.
 - B. gravitational contraction.
 - C. nuclear fission only.
 - D. both nuclear fusion and fission.
 - E. nuclear fusion only.
60. The cluster turn-off point is
- A. located at the cluster's apex in the sky.
 - B. used to find the ages of stars in a cluster.
 - C. located at the cluster's antapex in the sky.
 - D. hotter for older star clusters.
 - E. located near the Milky Way in the sky.
61. Listed in the order of their increasing density we would find as follows the degenerate or collapsed configurations of material which are equivalent in mass to stars along the main sequence:
- A. black holes, white dwarfs, neutron stars.

- B. neutron stars, black holes, white dwarfs.
 - C. black holes, neutron stars, white dwarfs.
 - D. white dwarfs, neutron stars, black holes.
62. For low-mass stars like the Sun, the red giant stage is followed by
- A. a planetary nebula and a white dwarf star.
 - B. a supernovae and a black hole.
 - C. a supernovae and a neutron star.
 - D. a planetary nebula and a neutron star.
63. The light variation of a Cepheid variable is best explained by the theory that Cepheids are
- A. binary stars
 - B. exploding
 - C. black holes
 - D. pulsating
 - E. rapidly rotating
64. The period-luminosity law for Cepheid variables is useful in obtaining
- A. All of these answers are correct
 - B. the distances of Cepheids
 - C. the masses of Cepheids
 - D. ages of Cepheids
 - E. the diameters of Cepheids
65. Where does the Crab Nebula ultimately get the energy which is observed as radiation being emitted by the nebula?
- A. from a pulsating white dwarf
 - B. from very fast vibrations of a neutron star
 - C. from a slowdown in the spin of a neutron star
 - D. from fusion of hydrogen to helium
 - E. from the original supernova explosion
66. The heavy elements we see in the universe probably were created mainly in
- A. Bethlehem Steel.
 - B. planetary nebulae.
 - C. nova explosions.
 - D. supernova explosions.
 - E. red giant stars.
67. The central stars of planetary nebulae
- A. captured the matter of the nebulae.
 - B. are cool stars.
 - C. ejected the matter found in the nebulae
 - D. have condensed out of the material of the nebulae.
68. A planetary nebula represents the transition between what two stages of a star?
- A. red giants and white dwarf
 - B. proto-star and red giant
 - C. proto-star and main sequence
 - D. red giant and supernova
 - E. main sequence and Cepheid variable

69. Even though they have average densities roughly equal to that of water, main sequence stars are gaseous because their interior temperatures are so high that they are completely ionized and the average particle size is therefore not the size of the atom, but the size of the nucleus of the atom
- A. True
 - B. False
70. The temperature in the center of the Sun is about _____ degrees K which is hot enough for _____ to occur.
- A. 15 thousand, hydrogen fusion
 - B. 15 million, hydrogen fusion
 - C. 15 hundred, nuclear fission
 - D. 15, unclear fishing
 - E. 15 billion, helium fusion
71. The "Northern Lights" are caused by
- A. gravitational contraction.
 - B. the solar wind.
 - C. nuclear fusion.
 - D. nuclear fission.
72. The following energy sources occur in the core of the Sun during its pre-main sequence, main sequence, and red giant stages respectively:
- A. hydrogen fusion, helium fusion, carbon fusion.
 - B. cosmic rays, gravitational contraction, hydrogen fusion.
 - C. helium fusion, hydrogen fusion, carbon fusion.
 - D. hydrogen fusion, gravitational contraction, helium fusion.
 - E. gravitational contraction, hydrogen fusion, helium fusion.
73. The elements more massive than iron were produced in
- A. white dwarf stars
 - B. the planets
 - C. proto-stars
 - D. main sequence stars
 - E. supernova explosions
74. A white dwarf is typically the size of ___ and _____ in nature.
- A. Mercury's orbit, liquid
 - B. the Sun, gaseous
 - C. a large city, metallic
 - D. the Earth's orbit, gaseous
 - E. the Earth, metallic
75. The Chandrasekhar limit implies that stars ending up more massive than 1.4 solar masses cannot become
- A. giant stars
 - B. supernovae
 - C. neutron stars
 - D. black holes
 - E. white dwarfs
76. Black holes are
- A. places where no matter can exist.
 - B. places where gravity prevents light from escaping.

- C. very cold stars.
 - D. always extremely massive objects.
77. The main reason Herschel thought the Milky Way galaxy was considerably smaller than it really is was because he did not include the effects of
- A. interstellar dust.
 - B. bright blue stars.
 - C. H II regions.
 - D. the lack of heavy elements in nearby stars.
 - E. radio and spectral lines.
78. O and B associations and their H II regions are usually found in what part of the galaxy?
- A. halo
 - B. globular clusters
 - C. spiral arms
 - D. nucleus
 - E. None of the other answers.
79. Complex molecules such as alcohol are found mostly in
- A. sunspots.
 - B. supernovae.
 - C. the atmospheres of hot stars.
 - D. emission nebulae.
 - E. dark dust clouds.
80. Interstellar dust
- A. is completely transparent.
 - B. causes the 21 cm radio emission.
 - C. causes starlight passing through it to appear more blue.
 - D. causes starlight passing through it to appear more red.
 - E. None of the other answers is correct.
81. A good example of a dark nebula is the
- A. Trapezium in Orion.
 - B. Crab Nebula in Taurus.
 - C. Horsehead Nebula in Orion.
 - D. Veil Nebula in Cygnus.
 - E. Ring Nebula in Lyra.
82. What color is a typical reflection nebula, and why?
- A. Red; hydrogen has a strong red spectral line.
 - B. Blue; blue light reflects better off dust particles.
 - C. Red; red light reflects better off dust particles.
 - D. Blue; the illuminating star is blue.
 - E. Red; it radiates like a red-hot black body.
83. Which type has no interstellar medium or young stars?
- A. spiral
 - B. elliptical
 - C. Seyfert
84. On average, the distance between galaxies is roughly a few million light years
- A. True
 - B. False

85. According to the Hubble law, clusters of galaxies twice as far away move _____ us _____ faster.
- A. towards, 4 2
 - B. away from, 4 x
 - C. away from, 2 x
 - D. towards, 2 x
86. The masses of spiral galaxies are calculated from their rotation curves by application of
- A. Hubble's law.
 - B. Kirchhoff's law.
 - C. Newton's second law.
 - D. Newton's third law.
 - E. Kepler's third law.
87. The particle nature of light is demonstrated by
- A. short wavelength of x-rays.
 - B. the photoelectric effect.
 - C. the interference effect.
 - D. refraction.
88. It is suspected that 'twin quasars' are
- A. identical quasars orbiting each other.
 - B. actually binary stars in the Milky Way.
 - C. two images of the same quasar produced by gravitation.
 - D. produced by a supernova explosion.
 - E. a double image produced by a defect in the telescope.
89. One successful test of the Big Bang theory for the origin of the universe is that it gives
- A. an age of the universe of about 100 billion years.
 - B. very few neutrinos.
 - C. the correct amounts of hydrogen and helium in old stars.
 - D. more atoms than photons in the universe.
 - E. redshifts of galaxies independent of distance.
90. One successful test of the Big Bang theory for the origin of the universe is that it gives
- A. more atoms than photons in the universe.
 - B. quasars close to the Milky Way.
 - C. an age of the universe near the ages of the oldest stars.
 - D. blue shifts for a few very distant galaxies.
 - E. equal amounts of hydrogen and helium.
91. Which elements were present when the universe was 500 seconds old?
- A. hydrogen
 - B. all the elements now present
 - C. only elements heavier than iron
 - D. hydrogen and helium
92. If the universe is closed
- A. the galaxies will expand forever.
 - B. it will fall back in on itself creating another fireball.
 - C. Hubble's law must be wrong.
 - D. it will become static.

93. The present data seem to indicate that the universe will probably
- A. eventually stop expanding and become static.
 - B. separate into two or more parts.
 - C. expand forever.
 - D. eventually recollapse.
 - E. None of the other answers are correct.