

Instructions:

Read each question carefully before answering.

Write your name, initials and student number in the appropriate boxes on the answer sheet.

WRITE YOUR TEST NUMBER IN THE 'OTHER DATA' BOXES ON THE FORM

Mark the appropriate box from A to D for each question.

You may use either a pencil or a pen. Any changes to an answer must be **clearly** shown.

1. How did Comet Shoemaker-Levy 9 achieve lasting fame?
 A. It exploded after passing too close to the Sun.
 B. It crashed into Jupiter.
 C. It became the first comet to be visited by spacecraft.
 D. It just missed the Earth, passing between the Moon and the Earth.
2. Who was the first to look at the Milky Way with a telescope?
 A. Johannes Kepler.
 B. Galileo Galilei.
 C. Sir Isaac Newton.
 D. Sir William Herschel.
3. The birthplace of the Sun and planets (and of other stars and maybe their planets) is thought to have been
 A. in the centers of galaxies.
 B. at the centers of supernova explosions.
 C. in black holes dotted about the universe.
 D. in cool gas and dust clouds.
4. The space between stars is known to contain
 A. a perfect vacuum.
 B. variable amounts of gas but no dust, which only forms in planetary systems near stars.
 C. dust and gas, both atomic and molecular.
 D. large quantities of dust that absorb light, but no gas, either atomic or molecular.
5. A particular star is brighter as seen through a blue filter than through a yellow filter. Which of the following surface temperatures is possible for this star?
 A. 12,000 °C.
 B. 3,000 °C.
 C. 4,500 °C.
 D. 6,000 °C.

6. A particular galaxy has a nuclear region of more-or-less uniform brightness from which long lanes of stars curve outwards. What type of galaxy is this?
 A. Irregular
 B. Quasar
 C. Spiral
 D. Elliptical
7. The internal structure of the Earth is
 A. a core of solid rock extensively enriched in iron, surrounded by a solid mantle of pure rock.
 B. a large, solid iron core surrounded by a thick, flexible mantle of rock.
 C. a core of rock and iron, surrounded by a mantle of liquid hydrogen.
 D. a large core of iron, partly solid and partly molten, surrounded by a thick, flexible mantle of rock.
8. What is a dwarf star?
 A. A star of about the same size (diameter) as the Earth.
 B. A main sequence star.
 C. A large, planetary object, such as Jupiter.
 D. Any star which is significantly smaller than a giant or supergiant star.
9. The mechanism of the "greenhouse effect," which has resulted in very high temperatures on the surface of Venus (and moderate temperatures upon Earth), can be described as
 A. solar UV and visible radiation being absorbed by the CO₂ of the atmosphere, thereby heating it.
 B. solar UV and visible radiation heating the planet surface, the infra-red emissions of which are trapped by CO₂ in the atmosphere.
 C. solar infra-red radiation heating the planet surface which then emits visible and UV radiation which is trapped by CO₂ in the atmosphere.
 D. solar UV and visible radiation entering the clouds and triggering chemical reactions in the CO₂ and sulfur compounds, the released energy then heating the atmosphere.
10. Fusion is the process by which
 A. clouds of interstellar gas and dust contract to form protostars.
 B. elements are transformed into heavier elements by nuclear reactions.
 C. dust grains and ice crystals coalesce to form planetesimals.
 D. massive protoplanetary cores pull gas onto themselves to create giant planets.

11. Observers in the 19th century reported seeing many straight-line features criss-crossing the surface of Mars, and interpreted these to be canals constructed by intelligent beings. What is the most likely present-day explanation for these observations?
- A. They were optical illusions caused by vague shadings on the planet surface.
 - B. They were lines of dark volcanoes similar to those of the Hawaiian Islands on Earth.
 - C. They were rifts in the Martian surface at the boundaries of geological tectonic plates.
 - D. They were linear, stationary cloud formations (mountain lee wave clouds) and weather fronts moving around with the planet.
12. Why do the larger craters on the Moon have central peaks?
- A. Debris falling from the crater walls has collected at the center of the crater floor.
 - B. The impact cracked the crust, and lava flowed into the center of the crater.
 - C. The crater floor rebounded upward after the initial compression.
 - D. The incoming projectile was large enough that it was not destroyed, and remained to form the central peak.
13. The word chromosphere refers to
- A. a layer in the Earth's atmosphere, just below the ionosphere.
 - B. a layer in the Sun's atmosphere.
 - C. a light-emitting region just outside the event horizon of a black hole.
 - D. a dense, spherical interstellar cloud of glowing gas.
14. To an astronomer, what is a "standard candle"?
- A. Any type of object whose absolute magnitude is known.
 - B. Any galaxy whose redshift has been measured accurately.
 - C. A standard light source that is placed in a telescope, to which the brightness of stars and other objects can be compared.
 - D. An accurately defined brightness scale for stars and galaxies, such as the magnitude scale.
15. Which satellite of Jupiter is volcanically active?
- A. Io.
 - B. Europa.
 - C. Ganymede.
 - D. Callisto.
16. The factor that misled Herschel into concluding that the stars of the Milky Way were distributed with the Sun at the center of the galaxy was
- A. that most of the "stars" that he measured were in fact distant galaxies that are distributed uniformly around the Sun.
 - B. hot hydrogen gas in the galaxy, its emission hiding the more distant stars.
 - C. gravitational bending of light by the mass of the galaxy, distorting the relative positions of the stars.
 - D. interstellar dust, which obscured the more distant stars and thereby localized his observations.

17. The rotation periods of Jupiter and Saturn are
- A. very short, on the order of 1 hour.
 - B. long, on the order of several days.
 - C. relatively short, on the order of 10 hours.
 - D. very long, several weeks, because of their great size and mass.
18. How many "tidal bulges" are there on the Earth, due to the Moon's gravitational pull?
- A. One, facing (almost) directly toward the Moon.
 - B. One, on the side of the Earth facing away from the Moon.
 - C. Four, one facing (almost) directly toward the Moon and the other three at 90° intervals from this one.
 - D. Two, one facing (almost) directly toward the Moon and one (almost) directly away from the Moon.
19. The nightly motion of objects across our sky is caused by
- A. rotation of the whole celestial sphere of stars around the fixed Earth.
 - B. the motion of the solar system around the galaxy.
 - C. rotation of the Earth on its axis.
 - D. revolution of Earth around the Sun.
20. Observation of the different components of the Milky Way galaxy indicates that the **spiral arms** contain very different populations of stars and other material to those in **globular clusters**. In what way are they different?
- A. Spiral arms contain young stars, dust and gas within which star formation continues, whereas globular clusters contain older star populations, with no dust and gas and no on-going star formation.
 - B. Both spiral arms and globular clusters contain about the same populations of stars both young and old but, in contrast to the spiral arms, there is no dust and gas, no star formation and there are no nova explosions in globular clusters.
 - C. Spiral arms contain older, more developed and hence brighter and bluer stars, while globular clusters are composed largely of young, red stars in the early stages of formation and development.
 - D. Globular clusters contain dust and gas and are the only locations where star formation continues in the galaxy at the present time. The older stars in the spiral arms have no surrounding dust or gas.
21. The Hertzsprung-Russell diagram is a plot of
- A. apparent brightness against intrinsic brightness of a group of stars.
 - B. luminosity against mass of a group of stars.
 - C. apparent brightness against distance for stars near to the Sun.
 - D. absolute magnitude (or intrinsic brightness) against temperature of a group of stars.

22. In modern astronomy, the constellations are
- A. a small number of well-defined groups of stars in our sky.
 - B. specific patterns of stars which point to certain directions, useful for navigation.
 - C. 88 sky regions covering the whole sky.
 - D. 12 specific regions through which the planets and Moon appear to move in our sky.
23. In astronomical terms, planetary nebulae are
- A. very long-lived objects, having been in existence since just after the Big Bang at the beginning of the Universe.
 - B. relatively short-lived, existing around the central white dwarf star for millions of years before slowly spreading into space.
 - C. very short-lived, with lifetimes of about 50,000 years.
 - D. relatively long-lived, since they form when the original stars form and remain as slowly rotating shells for the whole of their lifetimes of several billion years.
24. The overall geography of Mars can be best summarized as
- A. major volcanoes in the northern hemisphere, extensively cratered plains in the southern hemisphere, separated by one major valley system.
 - B. moving lithospheric plates whose motions have produced long folded mountain chains, deep subduction trenches, and several large rift valleys.
 - C. mostly rolling plains, with several volcanoes on top of two continent-sized uplands.
 - D. smooth plains where continuous resurfacing by ongoing volcanic activity has hidden older impact craters and other details.
25. Harlow Shapley first located the center of our Galaxy in 1917 by
- A. observing the distribution of globular clusters in the galactic halo.
 - B. redshift measurements on stars in the galactic plane and disk.
 - C. observing the distribution of hydrogen gas, measured by 21-cm radio emission.
 - D. measuring the positions of supernova explosions throughout the galaxy.
26. What process had the greatest influence on the features of the Moon during the first billion years of its existence?
- A. Mountain building from geological activity.
 - B. Impacts from space.
 - C. Volcanoes.
 - D. Erosion by an early, short-lived atmosphere.
27. Protostars are
- A. stars made almost entirely out of protons.
 - B. old stars, contracting after using up all of their available hydrogen fuel.
 - C. very young objects, still contracting before becoming true stars.
 - D. objects with masses less than about 0.08 solar masses, which do not have enough mass to become true stars.

28. Billions of years ago, the Earth's atmosphere was composed primarily of carbon dioxide. What happened to much of this carbon dioxide?
- A. It was broken into carbon and oxygen by solar ultraviolet light.
 - B. It is still in the atmosphere.
 - C. It was dissolved into the Earth's oceans.
 - D. It was lost to space.
29. According to modern theories, the most significant difference between the formation of the terrestrial and the large, outer planets is that
- A. the terrestrial planets formed close to the Sun where there was an abundance of rock but no ice, whereas the outer planets formed far from the Sun where there was an abundance of hydrogen and ice but no rocky material.
 - B. both formed by accretion of rocky and icy planetesimals, but the terrestrial planets were close enough to the Sun that almost all of the ices escaped back to space after the planets formed.
 - C. the terrestrial planets formed by accretion of planetesimals, whereas the outer planets formed by direct condensation of gas from the solar nebula.
 - D. both formed by accretion of planetesimals but the outer planets became massive enough to also pull gas onto them directly from the solar nebula.
30. How do astronomers measure the masses of stars?
- A. By observing the motion of two stars in a binary star system.
 - B. By observing the star's brightness at different wavelengths (colours).
 - C. By measuring the star's brightness, and obtaining its radius using the HR diagram.
 - D. By measuring the star's brightness, temperature, and distance.
31. What physical mechanism most probably caused the very long cracks and streaks that crisscross the surface of Europa, the moon of Jupiter?
- A. They are the tops of gigantic greenhouses built by inhabitants of Europa to protect their cucumber crops.
 - B. They are frozen rivers that, in warmer times, were flowing across the moon's surface.
 - C. Volcanic eruptions caused lava flows that then froze in place.
 - D. Tidal flexing by Jupiter cracked the surface, and subsurface fluids gushed upward and froze.
32. Suppose that the Next Generation Space Telescope, in 2010, discovers a series of planets with the following characteristics moving around a star that resembles our Sun: spherical, solid surfaces, mean densities about 4 times that of water, radii about 4000 km, low density atmospheres. What would these planets be classified as, in comparison to our solar system?
- A. Outer planets
 - B. Terrestrial planets
 - C. Cometary nuclei
 - D. Asteroids

33. What is an elliptical galaxy?

- A. Any galaxy with an elliptical halo when observed at radio wavelengths.
- B. A spiral galaxy with an elliptically shaped nuclear bulge and the spiral arms starting from the ends of the ellipse.
- C. A galaxy with an elliptical outline and a smooth distribution of brightness (no spiral arms).
- D. A spiral galaxy seen from an angle, giving it an elliptical profile.

34. The magnetosphere of Jupiter is

- A. a narrow layer in Jupiter's atmosphere, just above the cloud tops, in which intense electric currents flow and generate the planet's magnetic field.
- B. a region of charged particles extending along the orbit of the satellite Io, forming a ring around Jupiter.
- C. the magnetized hydrogen in the inner regions of Jupiter just outside the solid core, where the planet's magnetic field is produced.
- D. a large region outside Jupiter occupied by its magnetic field and filled with high-energy charged particles.

35. The characteristics of red supergiant stars are

- A. brightness of 10,000 Suns and a diameter of about Mars' orbit.
- B. brightness of the Sun and size of about Mercury's orbit.
- C. brightness of about 1 million Suns and a diameter of the whole solar system.
- D. brightness of about 10,000 Suns and a diameter of 1/10 of that of the Sun.

36. At opposition, when Mars comes relatively close to Earth, where would it be seen in the sky by an observer in the Earth's southern hemisphere?

- A. On the western horizon at midnight.
- B. High in the north at midnight.
- C. High in the south at sunset.
- D. High in the south at midnight.

37. The presence of a very large amount of unseen ("dark") matter in the halo of our Galaxy is deduced from

- A. the rotation curve of our Galaxy, in which orbital speeds of stars appear to obey Kepler's Law.
- B. the high amount of interstellar absorption in certain directions.
- C. the rotation curve of our Galaxy, in which orbital speeds of stars in the outer regions of the Galaxy are significantly higher than is predicted by Kepler's Law in which the value for the observed mass in the galaxy is used.
- D. the unexpected absence of luminous matter (stars, etc.) beyond a certain distance from the galactic center.

38. On which other world in the solar system do we find evidence of ice rafts (now apparently frozen), similar in many respects to ice rafts in the Earth's Arctic Ocean?

- A. Mars, at the edges of the polar caps.
- B. The icy surface of Jupiter's satellite, Europa.
- C. In the tropical regions of Saturn's satellite, Titan.
- D. Pluto, in the equatorial region facing most directly toward the Sun.

39. The Moon rotates synchronously as it orbits the Earth, always keeping one side pointed toward the Earth, because

- A. of the effect of the gravitational pull of the Earth on the tidally induced bulge on the Moon.
- B. of the effect of the magnetic field of the Earth on the magnetic field of the Moon, much like the effect upon a compass needle.
- C. of frictional effects from micro-meteoroids in its orbital plane, especially early in its history.
- D. it had precisely this rate of spin, equal to its revolution period around the Earth, when it was formed.

40. What is now considered to be the mechanism for the production of the double lobes of radio emission that appear on either side of many galaxies?

- A. The supernova explosion of a massive star and the ejection outwards in two opposite directions of very hot gas which emits thermal energy.
- B. Two oppositely directed jets of relativistic particles spiralling around magnetic fields.
- C. Material streaming in towards a black hole, perpendicular to and on opposite sides of the accretion disk.
- D. Radio emission from the two halves of galactic halos containing many globular clusters that generate radio-noise.

41. The major volcanoes on Mars have formed

- A. on long, interconnected ridges where magma, rising from the mantle, is pushing the crust apart.
- B. in mountain belts where the planet's surface is being stressed as it is bent and subducted back into the mantle.
- C. over individual stationary "hot-spots" in the underlying molten mantle.
- D. where shrinkage of the crust during cooling early in the planet's history has wrinkled the surface.

42. What is the distribution of giant molecular clouds in our galaxy and other similar galaxies?

- A. They are concentrated close to the galactic center.
- B. They are distributed uniformly throughout the disk.
- C. They occur primarily in the spiral arms.
- D. They are distributed throughout the halo, with greater density towards the center.

43. The cosmic background radiation is

- A. the result of the radioactive decay of heavier, unstable elements produced in supernova explosions.
- B. the electromagnetic remnants of the explosion in which the universe was born.
- C. the radio noise from hot gas in rich clusters of galaxies.
- D. the faint glow along the elliptic, caused by sunlight scattering from dust particles.

Session 1 Test, 2004
Dr. Michael Burton
TEST 1

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- 1. B
- 2. B
- 3. D
- 4. C
- 5. A
- 6. C
- 7. D
- 8. B
- 9. B
- 10. B
- 11. A
- 12. C
- 13. B
- 14. A
- 15. A
- 16. D
- 17. C

44. Why is there such a thing as stellar parallax?

- A. Because stars have size (they are not really just points of light).
- B. Because the Earth moves in space.
- C. Because stars move in space.
- D. Because the Earth rotates about its own axis.

45. The reddish color of Mars is probably due to

- A. vegetation turning red in the Martian autumn.
- B. iron oxides such as rust.
- C. the glow from the very high temperature surface on the sunlit parts of Mars.
- D. sulfur compounds thrown out by active volcanoes.

- 18. D
- 19. C
- 20. A
- 21. D
- 22. C
- 23. C
- 24. A
- 25. A
- 26. B
- 27. C
- 28. C
- 29. D
- 30. A
- 31. D
- 32. B
- 33. C
- 34. D
- 35. A
- 36. B
- 37. C
- 38. B
- 39. A
- 40. B
- 41. C

- 42. C
- 43. B
- 44. B
- 45. B