

Test Number

Instructions:

Read each question carefully before answering.

Write you name, initials and student numbber in the appropriate boxes.

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

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

1. Which is the lowest layer in the Earth's atmosphere?  
 A. The troposphere.  
 B. The stratosphere.  
 C. The thermosphere.  
 D. The magnetosphere.
  
2. Which of the following was NOT an important process in helping to remove carbon dioxide from the Earth's early atmosphere?  
 A. Sedimentation of carbon compounds onto the ocean floors.  
 B. Biological activity.  
 C. Dissolving of carbon dioxide into the oceans.  
 D. Escape of carbon dioxide into space.
  
3. What is ozone?  
 A. A combination of oxygen, nitrogen, and electrons.  
 B. Ionized oxygen atoms.  
 C. One of a number of chlorofluorocarbons (CFCs).  
 D. A molecule made of three oxygen atoms.
  
4. All of the boundaries of the major moving tectonic plates on the Earth's surface are coincident with  
 A. regions where ocean depths are greatest.  
 B. the occurrence of major auroral activity.  
 C. the edges of the continental shelves around the major continents.  
 D. the positions of maximum earthquake occurrence.
  
5. The San Andreas fault in California is an example of  
 A. two tectonic plates sliding past each other.  
 B. a spreading center, where two tectonic plates are being pushed away from each other.  
 C. an upthrust due to a hot spot in the Earth's mantle.  
 D. a subduction zone, where one plate is pushed back down into the Earth.

6. There are many reasons why a multi-day hiking trip on foot through the Valles Marineris on Mars would not be advisable, at least not without suitable protection. Which of the following conditions would NOT be a concern?
- A. The possibility of dust storms.
  - B. High levels of ultraviolet radiation.
  - C. Oppressively high atmospheric pressure.
  - D. The predominantly carbon dioxide atmosphere.
7. Where have some scientists hypothesized that they have found direct evidence for life, either contemporary or ancient, beyond the Earth (although the hypothesis has been strongly disputed by many other scientists)?
- A. In "orange soil" found on the Moon.
  - B. In a meteorite composed of ancient Martian rock.
  - C. In the "soil" (regolith) at the Viking 2 landing site on Mars.
  - D. In spectra of the dark deposits along fissures in the ice of Jupiter's satellite, Europa.
8. The formation of terrestrial-type of planets around a star is most likely to have occurred by what process?
- A. Break-up of a large disk of matter which formed around the star.
  - B. Condensation of gas from the original star nebula.
  - C. Accretion, or slow accumulation of smaller particles by mutual gravitational attraction.
  - D. Capture of objects traversing the depths of space by the star.
9. The rotation periods of Jupiter and Saturn are
- A. long, on the order of several days.
  - B. very long, several weeks, because of their great size and mass.
  - C. very short, on the order of 1 hour.
  - D. relatively short, on the order of 10 hours.
10. 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. a large region outside Jupiter occupied by its magnetic field and filled with high-energy charged particles.
  - D. the magnetized hydrogen in the inner regions of Jupiter just outside the solid core, where the planet's magnetic field is produced.
11. The reason for the vast amount of hydrogen in the interior of Jupiter is probably that
- A. the mass of the initial condensation of rocks at Jupiter's orbit was sufficient to attract vast amounts of gas to it.
  - B. Jupiter became so hot in its interior that all kinds of atoms and molecules were melted down to the fundamental atom, hydrogen.
  - C. nuclear fission of atoms in Jupiter's interior split all nuclei down to hydrogen nuclei early in its history.
  - D. Jupiter formed from the initial gravitational contraction of hydrogen gas.

12. Europa, one of the Galilean satellites of Jupiter, has a surface consisting of
- A. an icy crust showing two interlocking types of terrain, one ancient and heavily cratered, the other younger with systems of parallel grooves.
  - B. rock, heavily cratered like the highlands of our Moon.
  - C. an ancient, icy crust covered with numerous craters; no surface cracks or groove belts which would indicate internal activity.
  - D. a relatively young, icy crust covered with a network of streaks and cracks, and only a few impact craters.
13. 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 H<sub>2</sub>O, radii about 4000 km, low density atmospheres. What would these planets be classified as, in comparison to our solar system?
- A. Asteroids
  - B. Outer planets
  - C. Terrestrial planets
  - D. Cometary nuclei
14. The Kuiper belt is
- A. a spherical distribution of distant comets around the Sun, extending out about 50,000 AU.
  - B. a flat or donut-shaped distribution of distant comets around the Sun, extending out about 500 AU.
  - C. a random distribution of short-period comets extending from inside the orbit of Jupiter to approximately the orbit of Neptune.
  - D. another name for the asteroid belt.
15. Comets are typically
- A. chunks of ice that begin to vaporize if they pass close to the Sun.
  - B. slushy mixtures of liquid and ice.
  - C. gaseous bodies from which some of the gas is pushed out by the Sun to form a long tail.
  - D. chunks of rock typically a few tens of kilometers in diameter.
16. Fusion is the process by which
- A. elements are transformed into heavier elements by nuclear reactions.
  - B. massive protoplanetary cores pull gas onto themselves to create giant planets.
  - C. clouds of interstellar gas and dust contract to form protostars.
  - D. dust grains and ice crystals coalesce to form planetesimals.
17. Hydrogen and helium together account for what percentage of the total mass of all the matter in the universe?
- A. 75%
  - B. About 50%
  - C. 90%
  - D. 98%

18. The word chromosphere refers to
- A. a layer in the Sun's atmosphere.
  - B. a dense, spherical interstellar cloud of glowing gas.
  - C. a layer in the Earth's atmosphere, just below the ionosphere.
  - D. a light-emitting region just outside the event horizon of a black hole.
19. What is the solar wind?
- A. The constant flux of photons from the Sun's visible surface.
  - B. The circulation of gases between the equator and the poles of the Sun.
  - C. The storm of waves and vortices on the Sun's surface generated by a solar flare.
  - D. The Sun's outer atmosphere streaming out into space.
20. One particular feature of the solar corona is
- A. its variation with time over periods of a few minutes.
  - B. its very cold temperature.
  - C. its very high temperature.
  - D. its very uniform density and structure.
21. 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. 6,000 K.
  - B. 4,500 K.
  - C. 3,000 K.
  - D. 12,000 K.
22. The Hertzsprung-Russell diagram is a plot of
- A. absolute magnitude (or intrinsic brightness) against temperature of a group of stars.
  - B. apparent brightness against distance for stars near to the Sun.
  - C. luminosity against mass of a group of stars.
  - D. apparent brightness against intrinsic brightness of a group of stars.
23. A star in the lower left part of the Hertzsprung-Russell diagram, compared to a star in the middle of the diagram, is
- A. larger.
  - B. brighter.
  - C. cooler.
  - D. smaller.
24. The space between stars is known to contain
- A. dust and gas, both atomic and molecular.
  - B. variable amounts of gas but no dust, which only forms in planetary systems near stars.
  - C. large quantities of dust that absorb light, but no gas, either atomic or molecular.
  - D. a perfect vacuum.

25. Star formation takes place in
- A. giant molecular clouds.
  - B. H II regions.
  - C. hot, turbulent gas thrown out in a supernova explosion.
  - D. blue reflection nebulae.
26. Protostars are
- A. old stars, contracting after using up all of their available hydrogen fuel.
  - B. stars made almost entirely out of protons.
  - 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.
27. A planetary nebula is
- A. a contracting spherical cloud of gas surrounding a newly formed star in which planets are forming.
  - B. an expanding gas shell surrounding a hot white dwarf star.
  - C. a disk-shaped nebula of dust and gas, photographed around a relatively young star, from which planets will eventually form.
  - D. the nebula caused by the supernova explosion of a massive star.
28. 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.
29. Stars that have ejected a planetary nebula go on to become
- A. supernovae.
  - B. protostars.
  - C. red giants.
  - D. white dwarfs.
30. A high-mass star near the end of its life undergoes successive cycles of energy generation within its core in which gravitational collapse increases the temperature to the point where a new nuclear fusion cycle generates sufficient energy to stop the collapse. This process does not work beyond the silicon fusion cycle, which produces iron. Why is this?
- A. Fusion of iron nuclei into heavier nuclei requires energy rather than producing excess energy and therefore will not produce the additional gas pressure to halt the collapse.
  - B. Electrostatic forces between the highly charged iron nuclei are sufficient to overcome the collapse and stabilize the stellar core.
  - C. Iron nuclei are so large that they occupy all remaining space and so the collapse cannot continue.
  - D. The pressure from high-energy photons and neutrinos at the very high core temperatures reached at this stage of development is finally sufficient to halt the collapse.

31. Measurements suggest that light first arrived at Earth from the Cassiopeia A supernova about 300 years ago and that this supernova is about 10,000 light years away from Earth. When did the explosion actually occur?
- A. It is not possible to say when it occurred from the information given.
  - B. 10,300 years ago, or about 8300 BC.
  - C. 9,700 years ago, or about 7700 BC.
  - D. 300 years ago, or about 1700 AD.
32. The explosion of a supernova appears to leave behind
- A. a rapidly expanding shell of gas and a central neutron star.
  - B. a rapidly rotating shell of gas, dust and radiation, but no central object.
  - C. a rapidly expanding shell of gas and a compact white dwarf star at its center.
  - D. nothing; the explosion changes all the matter completely into energy which then radiates into space at the speed of light.
33. A black hole is so named because
- A. it emits no visible light because it is cold, less than 10 K.
  - B. its spectrum has the same shape as that of a laboratory blackbody, typically at a temperature of about 150 K.
  - C. no light can escape from it because of its powerful gravitational field.
  - D. the gravitational field is so high that the wavelength of the emitted light is shifted to radio wavelengths.
34. Radio waves of 21-cm wavelength originate from which component of the interstellar medium?
- A. Cool, carbon monoxide, CO.
  - B. Cold, molecular hydrogen, H<sub>2</sub>.
  - C. Hot, ionized atomic hydrogen.
  - D. Cool, neutral atomic hydrogen.
35. In the 1780s, Sir William Herschel tried to measure the Sun's position in our Galaxy by
- A. counting the density of stars in different directions along the Milky Way.
  - B. measuring distances to star clusters and H II regions in the disk of the Galaxy.
  - C. measuring the locations of globular clusters around the Galaxy.
  - D. comparing our Galaxy to photographs of the Andromeda galaxy.
36. Which two parameters of star motion in the Milky Way are represented by its rotation curve?
- A. Orbital period of the stars as a function of their distance from the galactic center.
  - B. Star position above or below the galactic plane as a function of distance from the galactic center.
  - C. Orbital speed as a function of star distance from the galactic center.
  - D. Orbital speed of the stars as a function of their individual masses.

37. What does a spiral galaxy look like when seen edge-on?
- A. A thick, flat line.
  - B. A thick line curved into a spiral shape.
  - C. Round but without spiral arms because they are hidden.
  - D. A thick, flat line with a bulge in the center.
38. 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. Quasar
  - B. Irregular
  - C. Elliptical
  - D. Spiral
39. What is an elliptical galaxy?
- A. Any galaxy with an elliptical halo when observed at radio wavelengths.
  - B. A galaxy with an elliptical outline and a smooth distribution of brightness (no spiral arms).
  - C. A spiral galaxy seen from an angle, giving it an elliptical profile.
  - D. A spiral galaxy with an elliptically shaped nuclear bulge and the spiral arms starting from the ends of the ellipse.
40. What is the Local Group?
- A. A group of galaxies clustered around the Andromeda Galaxy M31, apparently gravitationally bound to it but separate from the Milky Way.
  - B. A cluster of about 30 galaxies of which the Milky Way is a member.
  - C. A group of about 100 stars within 20 light-years of the Sun, which appear to have been formed at about the same time from similar material.
  - D. The stars which occupy the same spiral arm as the Sun.
41. Which of the following statements is most likely to be true, when discussing galactic motions and interactions?
- A. The universe is composed of one giant galaxy of which all observed stars are members, thus, the question of interaction between galaxies is irrelevant.
  - B. Galaxies are so widely separated that they never interact or collide.
  - C. Galaxies are so closely packed in the universe that they are always interacting with one another.
  - D. Galaxies occasionally collide with one another, particularly within clusters of galaxies.
42. The rotation curve of a galaxy is a graph showing the galaxy's speed of rotation at different distances from the center. The observed rotation curve in the OUTER PARTS of a typical large spiral galaxy
- A. decreases suddenly to zero at the outer edge of the visible galaxy.
  - B. increases drastically with increasing distance from the center.
  - C. is quite flat (roughly the same speed at all distances).
  - D. decreases smoothly with increasing distance from the center.

43. The primary evidence for the expanding universe concept is
- A. the redshift of light from distant galaxies, which increases with distance of the galaxy from Earth.
  - B. the slow increase in the Earth-Moon separation with time, about 4 cm per year.
  - C. the discovery of black holes in binary stars.
  - D. observation of supernova explosions.
44. What appears to be the central energy-generating system or "engine" that is producing prodigious amounts of energy in the centers of galaxies, active galaxies and quasars?
- A. A supermassive black hole, where matter is compressed upon falling into the hole and heated to extremely high temperatures.
  - B. A very rapidly rotating core of matter, where friction between it and the surrounding matter causes tremendous heat and energy output.
  - C. There is no central "engine" in these sources. Their high gravity has focused radiation from many sources beyond them by gravitational lensing and they thus appear to be very bright.
  - D. a steady series of supernova explosions, the late evolutionary stages of massive stars.
45. What produces the arcs of light which appear to be centered upon several clusters of galaxies?
- A. These arcs represent hot gas which is being heated by friction as it orbits a supermassive black hole in the center of the cluster of galaxies.
  - B. Gravitational bending of light from a single distant source by both the hidden and visible matter of the intervening cluster of galaxies.
  - C. The arcs are reflections of light from the galaxies by sheets of intergalactic dust and gas, similar to the sundogs and halos around the Sun caused by ice crystal clouds.
  - D. These arcs represent the ends of plasma jets, where the material in the jets has been stopped as it ploughs into dark matter within the cluster of galaxies.

## Answer Key

GENS 4001 Astronomy

Session 2 Test, September 2002

Dr Michael Burton

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Read each question carefully before answering.

Write you name, initials and student numbber in the appropriate boxes.

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

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

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

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

41. D

42. C

43. A

44. A

45. B