

**TEST 1**

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. In modern astronomy, the constellations are  
\_\_\_ A. a small number of well-defined groups of stars in our sky.  
\_\_\_ B. 12 specific regions through which the planets and Moon appear to move in our sky.  
\_\_\_ C. 88 sky regions covering the whole sky.  
\_\_\_ D. specific patterns of stars which point to certain directions, useful for navigation.
2. What basic pattern do stars follow over a period of hours as they are observed (or photographed) near the north celestial pole?  
\_\_\_ A. Wobbly circles, because of the precession of the Earth's axis.  
\_\_\_ B. Almost straight lines, because of the motion of the Earth in its orbit.  
\_\_\_ C. Circles with the north pole at the center.  
\_\_\_ D. Ellipses, with the north pole at the focus.
3. Which is the lowest layer in the Earth's atmosphere?  
\_\_\_ A. The troposphere.  
\_\_\_ B. The magnetosphere.  
\_\_\_ C. The thermosphere.  
\_\_\_ D. The stratosphere.
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 edges of the continental shelves around the major continents.  
\_\_\_ C. the occurrence of major auroral activity.  
\_\_\_ D. the positions of maximum earthquake occurrence.

5. What causes the auroras?

- \_\_\_ A. Charged particles emitting light as they spiral along magnetic field lines in the magnetosphere.
- \_\_\_ B. Light from solar flares reflecting from high-altitude clouds in the Earth's atmosphere.
- \_\_\_ C. Charged particles from the magnetosphere striking atoms in the upper atmosphere and causing the gases to emit light.
- \_\_\_ D. Solar ultraviolet light exciting ozone molecules in the ozone layer.

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

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

7. 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. High levels of ultraviolet radiation.
- \_\_\_ B. The possibility of dust storms.
- \_\_\_ C. The predominantly carbon dioxide atmosphere.
- \_\_\_ D. Oppressively high atmospheric pressure.

8. The reddish color of Mars is probably due to

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

9. 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 spectra of the dark deposits along fissures in the ice of Jupiter's satellite, Europa.
- \_\_\_ D. In the "soil" (regolith) at the Viking 2 landing site on Mars.

10. The Great Red Spot is

- \_\_\_ A. the colored polar cap of Jupiter.
- \_\_\_ B. a large, long-lived storm system in Jupiter's atmosphere.
- \_\_\_ C. the top of a massive mountain penetrating through Jupiter's clouds.
- \_\_\_ D. a temporary storm in Jupiter's atmosphere, lasting a few months.

11. The four giant moons of Jupiter were discovered by.
- \_\_\_ A. Newton.
  - \_\_\_ B. Galileo.
  - \_\_\_ C. the Voyager spacecraft.
  - \_\_\_ D. Ptolemy.
12. The most geologically active object in the planetary system at the present time is
- \_\_\_ A. Triton, a moon of Neptune.
  - \_\_\_ B. Mars.
  - \_\_\_ C. Io, a moon of Jupiter.
  - \_\_\_ D. the Earth's Moon.
13. The gas and ion tail of a comet
- \_\_\_ A. is always blown away from the comet in the anti-Sun direction by the solar wind.
  - \_\_\_ B. always trails along the orbital path, being left behind by the comet.
  - \_\_\_ C. lies between the comet and the Sun, because of gravitational attraction.
  - \_\_\_ D. always lies in the ecliptic plane, since a comet is a part of the solar system.
14. What is the photosphere of the Sun?
- \_\_\_ A. The core of the Sun, where nuclear energy is generated.
  - \_\_\_ B. The visible "surface" of the Sun.
  - \_\_\_ C. The middle layer of the Sun's atmosphere.
  - \_\_\_ D. The region of convecting gases below the visible surface of the Sun.
15. If granulation on the Sun's surface is a result of convective motion below it, and the centers of granular cells are where material is upwelling from below and returning in the regions between, what is the expected temperature distribution across a granular cell?
- \_\_\_ A. The center of the cell will be hotter than the edges.
  - \_\_\_ B. The center of the cell will be cooler than the edges.
  - \_\_\_ C. Alternate cell centers will be hot and cold, with the edges at an intermediate temperature.
  - \_\_\_ D. The temperature will be uniform across the cell.
16. The word chromosphere refers to
- \_\_\_ A. a layer in the Sun's atmosphere.
  - \_\_\_ B. a dense, spherical interstellar cloud of glowing gas.
  - \_\_\_ C. a light-emitting region just outside the event horizon of a black hole.
  - \_\_\_ D. a layer in the Earth's atmosphere, just below the ionosphere.

17. The solar wind is
- \_\_\_ A. the name for the electromagnetic radiation coming from the Sun.
  - \_\_\_ B. a violent explosive expansion of specific regions of the Sun's atmosphere at certain times.
  - \_\_\_ C. a gentle outflow of solar material, mostly protons and electrons, which is always moving outward from the Sun.
  - \_\_\_ D. the inflow of matter onto the Sun under gravitational attraction.
18. A star in the lower left part of the Hertzsprung-Russell diagram, compared to a star in the middle of the diagram, is
- \_\_\_ A. brighter.
  - \_\_\_ B. cooler.
  - \_\_\_ C. smaller.
  - \_\_\_ D. larger.
19. What is a dwarf star?
- \_\_\_ A. Any star which is significantly smaller than a giant or supergiant star.
  - \_\_\_ B. A large, planetary object, such as Jupiter.
  - \_\_\_ C. A star of about the same size (diameter) as the Earth.
  - \_\_\_ D. A main sequence star.
20. The space between stars is known to contain
- \_\_\_ A. variable amounts of gas but no dust, which only forms in planetary systems near stars.
  - \_\_\_ B. dust and gas, both atomic and molecular.
  - \_\_\_ C. a perfect vacuum.
  - \_\_\_ D. large quantities of dust that absorb light, but no gas, either atomic or molecular.
21. The characteristics of an open cluster of stars are
- \_\_\_ A. a few dozen members, the remnant of a globular cluster of stars from which most of the members have escaped.
  - \_\_\_ B. a few hundred members, often very young and still embedded in the gas and dust from which they were formed.
  - \_\_\_ C. hundreds of thousands of members, all very old, and no or very little interstellar gas and dust.
  - \_\_\_ D. many thousand members, of different ages.
22. What determines whether a particular region of an interstellar cloud can collapse and form a star?
- \_\_\_ A. The amount of gravity pulling inwards compared to gas pressure pushing outwards.
  - \_\_\_ B. Only the temperature, since higher temperatures act to prevent collapse.
  - \_\_\_ C. Only the amount of mass in the cloud, since this determines the strength of gravity.
  - \_\_\_ D. How the mass of the cloud compares to its diameter, since this determines how gravity compares to the distance needed to collapse.

23. Protostars are

- \_\_\_ A. very young objects, still contracting before becoming true stars.
- \_\_\_ B. stars made almost entirely out of protons.
- \_\_\_ C. objects with masses less than about 0.08 solar masses, which do not have enough mass to become true stars.
- \_\_\_ D. old stars, contracting after using up all of their available hydrogen fuel.

24. Infrared stars within the Orion nebula are examples of which stage of stellar evolution?

- \_\_\_ A. Protostar and young star
- \_\_\_ B. Planetary nebula
- \_\_\_ C. Supernova remnants
- \_\_\_ D. Red giant

25. In the Hertzsprung-Russell diagram, how does the position of a typical star change while it is at the main sequence phase of its evolution?

- \_\_\_ A. A star's position on the main sequence is determined only by its mass and not its age, and so, stars do not move along the main sequence during evolution.
- \_\_\_ B. Massive stars (4 solar masses) move toward the upper left as their luminosity increases, while lower-mass stars move toward the lower right as their temperature decreases.
- \_\_\_ C. Stars move from upper right to lower left while they are on the main sequence.
- \_\_\_ D. Stars move from upper left to lower right while they are on the main sequence.

26. What is happening in a star that is on the main sequence on the Hertzsprung-Russell diagram?

- \_\_\_ A. The star is slowly shrinking as it slides down the main sequence from top left to bottom right across the H-R diagram.
- \_\_\_ B. The star is generating internal energy by hydrogen fusion.
- \_\_\_ C. Stars that have reached the main sequence have ceased nuclear "burning" and are simply cooling down by emitting radiation.
- \_\_\_ D. The star is generating energy by helium fusion, having stopped hydrogen "burning".

27. How is the length of a star's lifetime related to the mass of the star?

- \_\_\_ A. The lifetimes of stars are too long to measure, so it is not known how (or if) their lifetimes depend on mass.
- \_\_\_ B. A star's lifetime does not depend on its mass.
- \_\_\_ C. Lower-mass stars run through their lives faster and have shorter lifetimes.
- \_\_\_ D. Higher-mass stars run through their lives faster and have shorter lifetimes.

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. 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.

30. What is the last nuclear burning stage in the life of a low-mass star like the Sun?

- \_\_\_ A. Fusion of helium nuclei to form carbon and oxygen.
- \_\_\_ B. Fusion of oxygen nuclei to form sulfur.
- \_\_\_ C. Fusion of hydrogen nuclei to form helium.
- \_\_\_ D. Fusion of silicon nuclei to form iron.

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. 10,300 years ago, or about 8300 BC.
- \_\_\_ B. 9,700 years ago, or about 7700 BC.
- \_\_\_ C. 300 years ago, or about 1700 AD.
- \_\_\_ D. It is not possible to say when it occurred from the information given.

32. 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.

33. The method used by Harlow Shapley in 1917 to estimate the Sun's location in our Galaxy was the measurement of

- \_\_\_ A. the locations of globular clusters around the Galaxy.
- \_\_\_ B. the density of stars in different directions along the Milky Way.
- \_\_\_ C. distances to open star clusters and H II regions in the disk of the Galaxy.
- \_\_\_ D. the structure of the Andromeda galaxy and a comparison of this to the structure of our galaxy.

34. Where in space would you look for a globular cluster?

- \_\_\_ A. In the Milky Way galactic halo, orbiting the galactic center in a long elliptical orbit around the galactic center.
- \_\_\_ B. Only in elliptical galaxies, since they are composed of old stars and do not exist in young systems like spiral galaxies.
- \_\_\_ C. In the Milky Way disk, moving in a circular orbit around the galactic center.
- \_\_\_ D. In the asteroid belt.

35. What is the distribution of giant molecular clouds in our galaxy and other similar galaxies?
- \_\_\_ A. They occur primarily in the spiral arms.
  - \_\_\_ B. They are distributed uniformly throughout the disk.
  - \_\_\_ C. They are distributed throughout the halo, with greater density towards the center.
  - \_\_\_ D. They are concentrated close to the galactic center.

36. Which of the following statements correctly describes the rotation of our galaxy?
- \_\_\_ A. The disk rotates like a solid object (objects at all distances take the same time to complete an orbit), and the halo objects have random orbits with no net rotation of the halo about the center of the galaxy.
  - \_\_\_ B. Objects in the disk have random orbits with no net rotation of the disk about the center of the galaxy, and the halo rotates differentially (objects further from the center take longer to complete an orbit than objects closer to the center).
  - \_\_\_ C. The disk rotates differentially (objects further from the center take longer to complete an orbit than objects closer to the center), and the halo objects have random orbits with no net rotation of the halo about the center of the galaxy.
  - \_\_\_ D. The disk rotates differentially (objects further from the center take longer to complete an orbit than objects closer to the center), and the halo rotates differentially (objects further from the center take longer to complete an orbit than objects closer to the center).

37. What is the basic shape of a spiral galaxy?
- \_\_\_ A. A round, flat disk with long lanes of stars that curve outwards right from the center of the galaxy.
  - \_\_\_ B. A round, flat disk with long lanes of stars that curve outwards from a round, nuclear region of uniform brightness.
  - \_\_\_ C. A round, thin disk of uniform brightness with its edges bent up and down into a spiral shape.
  - \_\_\_ D. Approximately spherical with long lanes of dark dust clouds curving through it in a spiral pattern.

38. The Andromeda Galaxy (M31) is best described as

- \_\_\_ A. a vortex surrounding a black hole.
- \_\_\_ B. a spiral collection of stars, dust, and gas, 200,000 light-years across.
- \_\_\_ C. a gaseous nebula, extending for 6° across our sky.
- \_\_\_ D. an extension of the Milky Way.

39. Why do the spiral arms show up so clearly in spiral galaxies?

- \_\_\_ A. Stars are spread almost uniformly over the galaxy (outside the nuclear bulge), but the brightest stars occur only in the spiral arms, making the arms stand out.
- \_\_\_ B. Stars occur only in the spiral arms (and the nuclear bulge), with essentially none between the arms, making the arms stand out brightly.
- \_\_\_ C. The number of stars in the arms is several times larger than in the regions between, so they stand out brightly.
- \_\_\_ D. Stars are spread uniformly over the galaxy but the dust forms a spiral pattern, absorbing starlight; the spiral arms are the dust-free regions between the dust lanes.

40. The biggest and intrinsically brightest galaxies in the universe are members of which group?

- \_\_\_ A. Irregular galaxies.
- \_\_\_ B. Barred spirals.
- \_\_\_ C. Large spirals.
- \_\_\_ D. Ellipticals.

41. The Magellanic clouds seen from the southern hemisphere are examples of what type of objects?

- \_\_\_ A. Planetary nebulae.
- \_\_\_ B. Irregular galaxies.
- \_\_\_ C. Supernova remnants.
- \_\_\_ D. Spiral galaxies.

42. Which of the following statements is most likely to be true, when discussing galactic motions and interactions?

- \_\_\_ A. Galaxies occasionally collide with one another, particularly within clusters of galaxies.
- \_\_\_ B. The universe is composed of one giant galaxy of which all observed stars are members, thus, the question of interaction between galaxies is irrelevant.
- \_\_\_ C. Galaxies are so widely separated that they never interact or collide.
- \_\_\_ D. Galaxies are so closely packed in the universe that they are always interacting with one another.

43. To an astronomer, what is a "standard candle"?

- \_\_\_ A. Any type of object whose absolute magnitude is known.
- \_\_\_ B. An accurately defined brightness scale for stars and galaxies, such as the magnitude scale.
- \_\_\_ C. Any galaxy whose redshift has been measured accurately.
- \_\_\_ D. A standard light source that is placed in a telescope, to which the brightness of stars and other objects can be compared.

44. The mechanism that appears to generate two extensive regions of radio emission near active galaxies is

- \_\_\_ A. the double image of a single source behind the galaxy, produced by gravitational lensing by the galaxy.
- \_\_\_ B. two very hot gas clouds, emitting 21-cm radio waves.
- \_\_\_ C. two oppositely directed jets of energetic particles.
- \_\_\_ D. two small black holes orbiting the center of the galaxy.

45. The "central engine" of an active galaxy appears to be

- \_\_\_ A. supernova explosions in an extremely dense star cluster at the center of the galaxy.
- \_\_\_ B. the violent merger of two galaxies, in which the collision throws out jets of matter along the rotation axis of the larger galaxy.
- \_\_\_ C. a supermassive black hole at the center of an accretion disk, with material being projected out perpendicular to the disk.
- \_\_\_ D. stars falling into a supermassive black hole, their remnants being thrown out in all directions.

## Answer Key

GENS 4001 Astronomy, Session 2 Test, 2003  
Course Lecturer: Dr Michael Burton

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

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

41. B

42. A

43. A

44. C

45. C