

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. Which is the lowest layer in the Earth's atmosphere?  
— A. The troposphere.  
— B. The magnetosphere.  
— C. The thermosphere.  
— D. The stratosphere.
2. Billions of years ago, the Earth's atmosphere was composed primarily of carbon dioxide. What happened to much of this carbon dioxide?  
— A. It is still in the atmosphere.  
— B. It was dissolved into the Earth's oceans.  
— C. It was lost to space.  
— D. It was broken into carbon and oxygen by solar ultraviolet light.
3. 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.
4. The internal structure of the Earth is  
— A. a core of rock and iron, surrounded by a mantle of liquid hydrogen.  
— B. a core of solid rock extensively enriched in iron, surrounded by a solid mantle of pure rock.  
— C. a large core of iron, partly solid and partly molten, surrounded by a thick, flexible mantle of rock.  
— D. a large, solid iron core surrounded by a thick, flexible mantle of rock.

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. Why do the larger craters on the Moon have central peaks?
- A. The incoming projectile was large enough that it was not destroyed, and remained to form the central peak.
  - B. The crater floor rebounded upward after the initial compression.
  - C. Debris falling from the crater walls has collected at the center of the crater floor.
  - D. The impact cracked the crust, and lava flowed into the center of the crater.
7. The Moon produces tidal disturbances on the oceans of Earth. In general, there are
- A. one high tide and one low tide per month.
  - B. two high and two low tides per day.
  - C. one high tide and one low tide per day.
  - D. two equal high tides and one low tide per day.
8. 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.
9. Mercury can only be seen easily from Earth
- A. in the winter, when the ecliptic plane is high in the sky at night.
  - B. near to the Sun, just after sunset or just before sunrise.
  - C. during a lunar eclipse, when the sky is sufficiently dark near to the Moon, since Mercury is always close to the Moon in our sky.
  - D. at midnight, when it is high in the sky.
10. An Earth-based telescopic view of Venus shows
- A. a crater-covered surface of reddish color.
  - B. a smooth, dark surface with few mountain ranges.
  - C. evidence of ice-covered polar caps and huge dust storms.
  - D. a completely cloud-shrouded planet with high atmospheric wind speeds.

11. In what way did optical illusion mislead earlier visual observers of Mars?
- \_\_\_ A. Chance alignments of faint dark features looked like manufactured canals and variable dark areas near the equator were interpreted as vegetation.
  - \_\_\_ B. Apparent movement of surface features because of seeing fluctuations of images when viewed through the Earth's atmosphere were interpreted as evidence of movement of life-forms or Martians.
  - \_\_\_ C. Volcano structures were seen as eye-shaped images, and were interpreted as having been made by intelligent beings to indicate their presence on Mars.
  - \_\_\_ D. Moving areas of obscured detail on the planet were interpreted as massive flash floods rather than dust storms.
12. The major volcanoes on Mars have formed
- \_\_\_ A. in mountain belts where the planet's surface is being stressed as it is bent and subducted back into the mantle.
  - \_\_\_ B. over individual stationary "hot-spots" in the underlying molten mantle.
  - \_\_\_ C. on long, interconnected ridges where magma, rising from the mantle, is pushing the crust apart.
  - \_\_\_ D. where shrinkage of the crust during cooling early in the planet's history has wrinkled the surface.
13. 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.
14. 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.
15. 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 a meteorite composed of ancient Martian rock.
  - \_\_\_ B. In the "soil" (regolith) at the Viking 2 landing site on Mars.
  - \_\_\_ C. In "orange soil" found on the Moon.
  - \_\_\_ D. In spectra of the dark deposits along fissures in the ice of Jupiter's satellite, Europa.
16. The rotation periods of Jupiter and Saturn are
- \_\_\_ A. relatively short, on the order of 10 hours.
  - \_\_\_ B. long, on the order of several days.
  - \_\_\_ C. very short, on the order of 1 hour.
  - \_\_\_ D. very long, several weeks, because of their great size and mass.

17. 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.

18. The magnetosphere of Jupiter is

- \_\_\_ A. a large region outside Jupiter occupied by its magnetic field and filled with high-energy charged particles.
- \_\_\_ 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 narrow layer in Jupiter's atmosphere, just above the cloud tops, in which intense electric currents flow and generate the planet's magnetic field.

19. The four giant moons of Jupiter were discovered by.

- \_\_\_ A. Newton.
- \_\_\_ B. Galileo.
- \_\_\_ C. the Voyager spacecraft.
- \_\_\_ D. Ptolemy.

20. 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.

21. The Kuiper belt is

- \_\_\_ A. a random distribution of short-period comets extending from inside the orbit of Jupiter to approximately the orbit of Neptune.
- \_\_\_ B. another name for the asteroid belt.
- \_\_\_ C. a spherical distribution of distant comets around the Sun, extending out about 50,000 AU.
- \_\_\_ D. a flat or donut-shaped distribution of distant comets around the Sun, extending out about 500 AU.

22. 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.

23. The difference in the brightness of a star as seen through two different colored filters, for example blue and yellow, is directly related to which stellar property?
- \_\_\_ A. Surface temperature.
  - \_\_\_ B. Distance from Earth.
  - \_\_\_ C. Luminosity.
  - \_\_\_ D. Radius.
24. 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. 4,500 °C.
  - \_\_\_ C. 6,000 °C.
  - \_\_\_ D. 3,000 °C.
25. 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.
26. 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.
27. 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.
28. 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.

29. 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.
30. Protostars are
- \_\_\_ A. very young objects, still contracting before becoming true stars.
  - \_\_\_ B. objects with masses less than about 0.08 solar masses, which do not have enough mass to become true stars.
  - \_\_\_ C. stars made almost entirely out of protons.
  - \_\_\_ D. old stars, contracting after using up all of their available hydrogen fuel.
31. Which of the following mechanisms is thought to be ineffective and inefficient in the triggering of star birth in molecular clouds?
- \_\_\_ A. Supernova explosions and the resultant shock waves.
  - \_\_\_ B. Gravitational contraction of a hot gas cloud.
  - \_\_\_ C. Pressure waves in the spiral arms of a galaxy.
  - \_\_\_ D. Collisions between two interstellar clouds.
32. 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.
33. The nuclear process in which helium "burning" occurs in the deep interiors of red giant stars produces
- \_\_\_ A. carbon and oxygen nuclei.
  - \_\_\_ B. hydrogen nuclei by splitting of helium nuclei.
  - \_\_\_ C. pure energy from the nuclear mass.
  - \_\_\_ D. iron nuclei.
34. 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.

35. 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.
36. 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. gravitational bending of light by the mass of the galaxy, distorting the relative positions of the stars.
  - \_\_\_ B. that most of the "stars" that he measured were in fact distant galaxies that are distributed uniformly around the Sun.
  - \_\_\_ C. interstellar dust, which obscured the more distant stars and thereby localized his observations.
  - \_\_\_ D. hot hydrogen gas in the galaxy, its emission hiding the more distant stars.
37. 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.
38. 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.
39. The time taken for the Sun to orbit the galactic center once in its motion in the Galaxy is
- \_\_\_ A. 28, 000 years.
  - \_\_\_ B. 230 million years.
  - \_\_\_ C. 2.3 million years.
  - \_\_\_ D. about 1/2 million years.
40. 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. Spiral
  - \_\_\_ B. Quasar
  - \_\_\_ C. Irregular
  - \_\_\_ D. Elliptical

41. 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.
42. What is an elliptical galaxy?
- \_\_\_ A. A galaxy with an elliptical outline and a smooth distribution of brightness (no spiral arms).
  - \_\_\_ B. A spiral galaxy with an elliptically shaped nuclear bulge and the spiral arms starting from the ends of the ellipse.
  - \_\_\_ C. Any galaxy with an elliptical halo when observed at radio wavelengths.
  - \_\_\_ D. A spiral galaxy seen from an angle, giving it an elliptical profile.
43. 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.
44. 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.
45. For which objects in the universe has the Hubble relation been shown to hold experimentally?
- \_\_\_ A. Stars in the near neighborhood of the Sun, in our Galaxy.
  - \_\_\_ B. Stars in the distant spiral arms of our Galaxy.
  - \_\_\_ C. Distant galaxies.
  - \_\_\_ D. Galaxies in the Local Group, in the near vicinity of the Milky Way.

**Answer Key**

Session 1 Test, 2003  
Dr Michael Burton  
**TEST 1**

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

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

42. A

43. A

44. A

45. C