

GENS 4001 ASTRONOMY

Session 1 Test, May 1, 2000
Dr Michael Burton

TEST 1

Instructions:
Read each question carefully before answering.

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

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

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

YOU HAVE 1 HOUR

Tomorrow's weather report for Venus would be
snow.
overcast and very hot.
cold and clear.
hot and humid, with clear skies.

How is cool, neutral hydrogen gas, H I, detected in the spiral arms of galaxies?
By the absorption of infra-red radiation from extragalactic sources.
By its ultraviolet, Lyman α , hydrogen line emissions.
By its 21 cm line radio emissions.
By its Balmer line emissions.

Where on the Hertzsprung-Russell diagram do most local stars in our Universe congregate?
In the white dwarf area, the "graveyard" of stars.
In the giants area, where most stars spend the longest time of their lives.
On the main sequence, where stars are generating energy by fusion reactions.
In the supergiant area, where the most massive stars spend a significant time.

Who developed the classification system that divides galaxies into spiral, elliptical and irregular, and classifies spirals by the size of their nuclear region and the tightness of winding of their arms?
Olaus Roemer
Edwin Hubble
Ejnar Hertzsprung
Sir John Herschel

5. Which of the planets fits the following description: "Cool, solid surface with an atmosphere of N_2 and O_2 , and H_2O clouds"?
- Earth
 - Mercury
 - Venus
 - Mars

A planetary nebula is

a contracting spherical cloud of gas surrounding a newly formed star in which planets are forming.
the nebula caused by the supernova explosion of a massive star.
a disk-shaped nebula of dust and gas, photographed around a relatively young star, from which planets will eventually form.
an expanding gas shell surrounding a hot white dwarf star.

What characteristic of Jupiter's satellite, Io, makes it different from any other known satellite in the solar system?

It has a permanent, dense atmosphere.
It is volcanically active.
Its surface is broken into heavily cratered and lightly cratered regions in a pattern similar to plate tectonics.
It has geyser-like plumes of nitrogen gas.

Which path would a planet (like Earth!) take if the force of gravity from the Sun were to be suddenly removed?

The planet would move in a straight line outwards, directly away from the Sun's position.
The planet would stop moving altogether since there would now be no gravity acting upon it.
The planet would begin to move in a long ellipse with the Sun at one focus.
The planet would move in a straight line tangential to its present orbit.

"Standard candles," which are important for finding distances to remote galaxies, are
heat sources used for calibrating infra-red observations of galaxies.
standard bars of known length with which the size of a galaxy can be measured.
standard laboratory light sources with which the brightness of a galaxy can be compared.
stars and other objects of known intrinsic brightness.

How were the mountain ranges on the Moon formed?

They were pushed up by the collisions of tectonic plates on the lunar surface.
They are wrinkles in the crust, created when the Moon cooled and shrunk slightly in size.
They are "spreading centers," where magma from the mantle is rising and pushing tectonic plates apart.
They were thrust up as crater walls by impacts of large asteroids.

11. An asteroid is

- a planetesimal moving in an orbit around the Sun.
- a meteorite before it enters the atmosphere and plunges to Earth.
- a small, easily recognizable group of stars within a constellation.
- another name for the nucleus of a comet, a volatile object which moves around the Sun in a long, elliptical orbit.

What is a white dwarf star?

- A main sequence star with a surface temperature near 12,000 K.
- A star of about the same size (diameter) as the Earth.
- Any star which is significantly smaller than a giant or supergiant star.
- A large, planetary object, such as Jupiter.

Black holes are so named because

- all of their electromagnetic gravitationally redshifted to the infrared, leaving no light in the optical region.
- their only spectral lines are in the radio and infrared.
- they emit a perfect blackbody spectrum.
- no light or any other electromagnetic radiation can escape from inside them.

Our Galaxy is

- an isolated galaxy, not a member of any cluster.
- one member of a large, irregular cluster of thousands of galaxies.
- one member of a large, regular cluster of thousands of galaxies.
- one member of a small cluster of galaxies.

What process provides the power for the Sun?

- The fusion of hydrogen into helium.
- The fission of uranium to form lead.
- The fusion of helium into carbon.
- The emission of neutrinos.

What are the characteristic features on the visible surface of Jupiter?

- A bluish tint with high, white clouds and dark storms.
- A Bluish-green, almost featureless, cloud layer.
- Large volcanoes and a long, deep rift valley.
- Light and dark bands of clouds parallel to the equator.

The major volcanoes on Mars have formed

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

18. What point defines the end of the pre-main-sequence phase of a star's life and the start of the main-sequence phase?

- It begins to expand and become a red giant.
- It stops accreting mass from the interstellar cloud.
- Convection begins in its interior.
- Nuclear reactions begin in its core.

We know that water exists on Mars, but where and in what state does it NOT exist on this planet?

- In permafrost, below the surface.
- In polar icecaps.
- As water vapor in the atmosphere and as clouds.
- Flowing in river valleys.

Eclipses of the Moon can only occur

- in June and December, when the Sun is near the solstices.
- at New Moon.
- at Full Moon.
- in the spring and fall seasons, when the Sun is on the ecliptic plane.

The existence of the Great Red Spot of Jupiter has been known since

- the 1600s.
- the arrival at Jupiter of Voyager 1, with its imaging cameras, in 1979.
- first light at the 200 inch telescope on Mt Palomar, in 1948.
- the first fly-by of a spacecraft, Pioneer 10, in December, 1973.

Which single major problem perhaps puzzles astronomers the most as they attempt to interpret the properties and behavior of clusters of galaxies?

- The presence of star formation in many galaxies, long after it is expected to have died out.
- The rate of supernova occurrence in galaxies in some clusters.
- The structure and motion of spiral arms in galaxies in many clusters.
- The missing-mass problem, with at least 10 times more than the observed mass needed for galactic cluster stability.

Which effects have been useful (and successful?) in the search for and identification of black holes in the universe?

- The effect of their angular momentum or spin on nearby matter.
- The influence of their intense gravitational field on atoms that are emitting light from the event horizons of the black holes.
- Their magnetic fields and the influence on these fields upon nearby matter.
- Their gravitational influence on nearby matter, particularly companion stars.

24. Which of the following is not a region of the Earth's atmosphere or near-Earth environment?

- The magnetosphere.
- The chromosphere.
- The stratosphere.
- The troposphere.

The total time that the Sun will spend converting hydrogen to helium in its core is

- about 1 million years.
- about 10 billion years (10^{10} years).
- at least 200 billion years ($2 > 10^{11}$) years.
- about 4.5 million years.

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

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

The great mountain ranges of the Earth have been produced by

- wrinkling of the crust as the interior cools and contracts.
- volcanic eruptions.
- asteroid impacts, since they are just worn-down crater walls.
- collisions between tectonic plates.

One of the consequences of the collision of two galaxies appears to be

- a burst of vigorous star birth.
- a very large explosion, similar to but much larger than a supernova.
- almost nothing, since stars are widely separated in each galaxy and the probability of star-star collisions is very small.
- the disappearance of one of them into the central black hole of the other.

The space between stars is known to contain

- large quantities of dust that absorb light, but no gas, either atomic or molecular.
- dust and gas, both atomic and molecular.
- variable amounts of gas but no dust, which only forms in planetary systems near stars.
- a perfect vacuum.

The approximate temperature of the visible surface of the Sun is

- 4300 K.
- 10,000 K.
- 5800 K.
- 2000 K.

31. The core collapse phase at the end of the life of a massive star is triggered when

- the helium flash and thermal pulses have expelled the star's envelope.
- nuclear fusion has produced a significant amount of iron in its core.
- the density reaches the threshold for electron degeneracy pressure to become important.
- the core becomes as dense as an atomic nucleus.

In the eighteenth century, Sir William Herschel used star counts in different regions of the sky along the Milky Way to estimate the position of the center of the Milky Way. He incorrectly concluded that the Sun was close to that center. The reason for this erroneous conclusion was

- the large quantity of absorbing dust between stars, which obscured the more distant regions of the Galaxy.
- that the redshift of the more distant stars made them invisible to Herschel.
- that emissions from hot hydrogen gas clouds served to hide the more distant stars, localizing his search.
- that Herschel counted all "stars" in each star field, and included many galaxies were outside our Galaxy, thus confusing the distribution.

The time taken for the Sun to orbit the galactic center once in its motion in the Galaxy is

- 230 million years.
- 2.3 million years.
- about 1/2 million years.
- 28, 000 years.

The so-called "canals," which Schiaparelli reported seeing upon the surface of Mars, were actually

- an optical illusion.
- the remnants of the walls of ancient craters which have been eroded by winds and dust over Mars' history.
- river valleys, caused by massive floods early in Mars' history.
- lines of volcanoes along faults in the Martian surface.

The most likely places where stars and planetary systems are forming in the universe are

- in nebulae composed of gas and dust.
- in the centers of galaxies.
- in regions surrounding quasars.
- in the rarified space between galaxies.

Where in space would you look for a globular cluster?

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

37. The next stage in a star's life after the main sequence phase is
- the red giant phase.
 - the horizontal branch phase.
 - a protostar.
 - death (i.e., either a supernova or a white dwarf).

The Hertzsprung-Russell diagram is a plot of

- absolute magnitude (or intrinsic brightness) against temperature of a group of stars.
- luminosity against mass of a group of stars.
- apparent brightness against distance for stars near to the Sun.
- apparent brightness against intrinsic brightness of a group of stars.

A typical granule on the surface of the Sun

- is about 30,000 km across and lasts for several hours.
- is a few thousand kilometers across and lasts for about two solar rotations.
- is about 1000 km across and lasts for a few minutes.
- arches quietly for several days over a sunspot group.

The visible corona of the Sun is most effectively photographed

- during solar eclipses.
- during lunar eclipses, when the sky is darker.
- in spring and fall seasons, because of the tilt of the spin axis of the Sun.
- at solar maximum periods, over a period of a few years.

Which are the two most abundant elements in the universe?

- Nitrogen and oxygen.
- Hydrogen and helium.
- Hydrogen and carbon.
- Hydrogen and oxygen.

Where is the solar system located in our galaxy?

- It is not in a galaxy, but in the intergalactic space between galaxies.
- In the galactic nucleus.
- In the galactic halo.
- In the galactic disk.

The gas and ion tail of a comet

- always lies in the ecliptic plane, since a comet is a part of the solar system.
- always trails along the orbital path, being left behind by the comet.
- lies between the comet and the Sun, because of gravitational attraction.
- is always blown away from the comet in the anti-Sun direction by the solar wind.

44. The Milky Way is an example of which type of galaxy?
- Irregular.
 - Lenticular, S0 type.
 - Spiral.
 - Elliptical.

The dimensions of the disk of our Milky Way Galaxy are

- diameter 28,000 light-years; thickness 2000 light-years.
- diameter 100,000 light-years; thickness, 2000 light-years.
- diameter 10,000 light-years; thickness, 28,000 light-years.
- diameter 2000 light-years; thickness, 100,000 light-years.

Answer Key

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