

# Astronomy 161 Final Exam

## December 9, 2002

### WHITE VERSION

Select the single best answer for each question, unless otherwise instructed. No notes or calculators are permitted. Each question is 1 point unless otherwise noted.

1. The planet with the shortest period of revolution is  
(a) Venus.     (b) Mercury.    (c) Pluto.    (d) Jupiter.

The revolution period is how long it takes the planet to go around the sun.

2. The planet with the shortest period of rotation is  
(a) Venus.    (b) Mercury.    (c) Pluto.     (d) Jupiter.

The rotation period is how long it takes the planet to spin on its axis. Jupiter is fastest.

3. According to Kepler's second law, comets (which have very eccentric orbits) should spend  
(a) most of their time close to the sun.     (b) most of their time far from the sun.  
(c) equal times close to and far from the sun.

Kepler's second law says planets move slower when they are further from the sun.

4. The astronomer who first discovered that another planet has moons revolving around it as it orbits the sun was  
(a) Tycho Brahe.     (b) Galileo Galilei.    (c) Claudius Ptolemy.    (d) Johannes Kepler.

Galileo discovered four of the moons of Jupiter.

5. The scientist who worked from first principles and discovered **why** the planets move in elliptical orbits was  
 (a) Isaac Newton.    (b) Galileo Galilei.    (c) Claudius Ptolemy.    (d) Johannes Kepler.

Kepler discovered the fact that planets move in elliptical orbits by examining Tycho Brahe's data. Newton explained the laws using his theory of universal gravitation and the basic laws of physics.

6. A fundamental problem of telescopes with lenses is \_\_\_\_\_, which means different wavelengths of light focus at different points.  
(a) astigmatism    (b) color refraction     (c) chromatic aberration    (d) spherical aberration

7. To separate light into the component colors that it contains astronomers use a device called  
(a) a CCD.    (b) an interferometer.     (c) a spectrometer.    (d) a radiometer.

8. The most important function of an astronomical telescope is to
- (a) enlarge celestial objects so we can see them clearly.
  - (b) collect as much light as possible and bring it to a focus.
  - (c) make distant objects appear closer.
  - (d) help us see through the earth's atmospheric distortions.

Stars are too far away to appear closer or even bigger in a telescope. But a telescope can gather much more light, allowing it to be analyzed better.

9. This planet has an atmospheric pressure one hundredth that of Earth's.
- (a) Mercury
  - (b) Venus
  - (c) Mars
  - (d) Pluto

Mercury and Pluto have nearly insignificant atmospheres, and Venus has a very dense one. Mars's atmosphere is one hundredth that of Earth's, which is small but not insignificant.

10. Which of the following wavelengths is NOT strongly absorbed by the atmosphere?
- (a) UV
  - (b) IR
  - (c) gamma rays
  - (d) X rays
  - (e) radio waves

Optical and radio wavelengths are the two windows for Earth-based observations.

11. The highest frequency region of the electromagnetic spectrum is called the \_\_\_\_ region.
- (a) UV
  - (b) IR
  - (c) gamma ray
  - (d) X ray
  - (e) radio frequency

In order of increasing frequency, these are radio frequency, IR, UV, X ray, gamma ray.

12. The property of light that allows it to bend around corners is called
- (a) diffraction.
  - (b) reflection.
  - (c) refraction.
  - (d) dispersion.

13. The Apollo and Aten asteroids are of more concern to us on Earth than any other types of asteroids because
- (a) these are the largest asteroids.
  - (b) these have evidence of past life forms in the form of amino acids.
  - (c) these are among the oldest objects in the solar system.
  - (d) their orbits cross Earth's orbit and collisions are possible.

14. The reason for the asteroid belt's location is
- (a) one planet used to be there but it exploded.
  - (b) some of the satellites of Jupiter escaped.
  - (c) Proto-Jupiter's tidal forces prevented one planet from accreting.
  - (d) Mars's gravity made orbits in this region unstable.

15. Most of the rocks in the lunar Maria are
- (a) breccias.
  - (b) basalts.
  - (c) sedimentary.
  - (d) granite.
  - (e) organic.

The lunar Maria are volcanic in origin, and basalts are volcanic rock.

16. The mountains of the moon
- (a) are the peaks of now-extinct volcanoes.
  - (b) result from the collisions of tectonic plates.
  - (c) are crater rims from large meteorite impacts.
  - (d) are very small compared to Earth's mountains.

There are no extinct volcanoes or tectonic plates on the moon, and some of these mountains are larger than Mt. Everest. The crater rims were formed by impacts.

17. Early Chinese observations of solar eclipses have been useful of studies of what phenomenon?  
 (a) global warming (b) the decreasing earth-moon distance  
 (c) slowing of the Earth's rotation (d) changes in the solar radius
18. A comet will not last forever once it is turned in its orbit to come near the Sun because  
 (a) comets always hit the Sun eventually.  
 (b) it is sure to collide with a planet eventually.  
 (c) the lost material in its tail means it will evaporate away.  
 (d) close passes by the sun will eventually eject it from the solar system.
19. Most long-period comets come from  
 (a) the Oort Cloud. (b) the Kuiper Belt. (c) the Asteroid Belt. (d) outside the solar system.
20. The coma and tail of Halley's Comet consist primarily of vaporized \_\_\_\_\_ ice.  
 (a) methane  (b) water (c) ammonia (d) carbon dioxide
21. A meteor shower occurs when  
 (a) the earth collides with an asteroid. (b) a comet collides with the sun.  
 (c) Earth crosses the orbit of a comet. (d) two asteroids collide near Earth.
22. Which of the following classes of objects orbit the sun in every possible direction?  
 (a) asteroids  (b) long period comets (c) short period comets (d) Kuiper Belt Objects

The long period comets come from the Oort Cloud, which is spherical. They come in all directions.

23. The Kuiper Belt is located  
 (a) between Mars and Jupiter. (b) beyond Neptune, at about 50 AU.  
 (c) about 50,000 AU from the Sun. (d) between the orbits of the Jovian planets.
24. The clouds of Venus are composed of  
 (a) sulfuric acid. (b) methane. (c) carbon dioxide. (d) water vapor.
25. If the angle between the Sun and Moon in the sky is 45 degrees, the phase of the Moon is  
 (a) new.  (b) crescent. (c) quarter. (d) gibbous. (e) full.
26. The layer of the Earth's atmosphere in which the temperature decreases as the altitude increases, but no weather occurs, is called the  
 (a) ionosphere. (b) troposphere. (c) stratosphere.  (d) mesosphere.

The temperature also decreases as you rise in the troposphere, but that is where we have our weather.

27. The warmest temperatures in the Earth's atmosphere occur in the  
 (a) ionosphere. (b) troposphere. (c) stratosphere. (d) mesosphere.

Surprisingly, the highest temperatures occur highest in the atmosphere, due to bombardment by the solar wind. However, the atmosphere is very sparse at such elevations.

28. Why is the Earth's rotation gradually slowing?  
 (a) because of repeated meteor impacts  (b) friction caused by tidal forces  
 (c) the tilt of the Earth's axis (d) a gradual change in the sun-earth distance
29. Which of the following has retrograde motion?  
 (a) Mercury  (b) Venus (c) Neptune (d) Saturn (e) Phobos
30. The planet with the highest core temperature is  
 (a) Mercury (b) Venus (c) Earth  (d) Jupiter

Jupiter's high (30,000K) core temperature is due to the extreme pressure of gravitational contraction.

31. The planet with the highest average surface temperature is  
(a) Mercury     (b) Venus    (c) Earth    (d) Jupiter

Due to a runaway greenhouse effect, Venus's average surface temperature is hotter than Mercury's.

32. The energy source for the Earth's interior heat and to drive plate tectonics is  
(a) tidal forces    (b) internal friction    (c) gravitational contraction     (d) radioactive decay
33. Doppler methods are biased toward finding extrasolar planets  
(a) smaller than Earth.    (b) composed of hydrogen.  
(c) with orbital periods greater than 20 years.     (d) with orbital planes along the line of sight.

The Doppler methods rely on back and forth motion with respect to the Earth. This is greatest if the orbital plane is along our line of sight.

34. The type of seismic wave that travels fastest and arrives first at a seismograph station is  
(a) L waves.     (b) P waves.    (c) S waves.    (d) IR waves.    (e) UV waves.

P stands for Primary or Pressure waves, which travel faster than S (Secondary or Shear) waves.

35. The highest mountains on Earth are caused by  
(a) subduction zones.    (b) transverse faults.     (c) collisions of continental plates.    (d) volcanism.

The Indian continental plate is the fastest of all, and is pressing under Asia's plate to form the Himalayas.

36. The location in the sky that was chosen for the zero measure of right ascension is  
(a) the celestial equator.    (b) the Prime Meridian.     (c) the vernal equinox.  
(d) the autumnal equinox.    (e) the star Polaris.

The vernal equinox is the position along Earth's orbit where it crosses the Celestial Equator in the spring time. The position of the sun at that time is the zero measure of right ascension.

37. The right ascension of the Sun on the summer solstice (June 22) is  
(a) 0 hours.     (b) 6 hours.    (c) 12 hours.    (d) 18 hours.

The summer solstice is a quarter of an orbit around the sun from the vernal equinox.

38. The declination of Polaris, viewed from Knoxville at a latitude of 36 degrees N, is  
(a) 0 degrees N.    (b) 36 degrees N.    (c) 54 degrees N.     (d) 90 degrees N.

Polaris is over the north pole, so its declination is 90 degrees N.

39. The altitude of Polaris, viewed from Knoxville at a latitude of 36 degrees N, is  
(a) 0 degrees.     (b) 36 degrees N.    (c) 54 degrees N.    (d) 90 degrees N.

The altitude is the angle above the horizon where Polaris is found. This angle always is the same as the latitude of the observer. On the North Pole, Polaris would be directly overhead. On the equator, Polaris would be on the horizon.

40. The Sun is at the zenith on the summer solstice at a latitude of  
(a) 0 degrees.    (b) 23.5 degrees S.     (c) 23.5 degrees N.    (d) 66.5 degrees N.

The furthest north the sun can be found at zenith is determined by the 23.5 degree tilt of the Earth.

41. Neap tides occur when the phase of the Moon is  
(a) full. (b) new.  (c) quarter. (d) waxing. (e) waning.

Neap tides are the weakest tides produced when the Sun and Moon act on the Earth at right angles. This corresponds to either a first or third quarter phase.

42. The favored theory of lunar formation is  
(a) co-accretion  (b) giant impact (c) fission (d) capture
43. The only planet with a rotational period longer than its revolution period is  
(a) Mercury.  (b) Venus. (c) Uranus. (d) Pluto.
44. The only bodies in the Solar System to show clear Evidence of plate tectonics are the Earth and  
(a) Venus. (b) Mars. (c) the Earth's Moon.  (d) Ganymede. (e) Titan.
45. Which is not a Galilean moon?  
(a) Io  (b) Titan (c) Callisto (d) Europa (e) Ganymede

Titan is Saturn's major moon.

46. The total mass of the Oort cloud is  
 (a) the mass of a few Earths. (b) the mass of a small moon.  
(c) more than all the planets combined. (d) the mass of a Jovian planet.
47. Jupiter's magnetic field originates in a layer composed of  
(a) liquid water and ammonia.  (b) liquid metallic hydrogen. (c) rock and ice. (d) molten iron.
48. The most volcanically active body in the solar system is  
 (a) Io. (b) Ganymede. (c) Mercury. (d) Venus.
49. The densest planet is  
(a) Venus.  (b) Earth. (c) Jupiter. (d) Saturn.
50. The least dense planet is  
(a) Mars. (b) Jupiter.  (c) Saturn. (d) Pluto.
51. The basic building blocks of life found in Meteors are  
 (a) amino acids. (b) complex carbohydrates. (c) nucleotides. (d) glycols.
52. Stony meteorites are  
(a) formed in the core of a fractured asteroid.  (b) pieces of the crust of an asteroid.  
(c) pieces of a comet nucleus. (d) the least common type of meteorite.
53. Comet-like asteroids similar to Kuiper Belt Objects but in closer orbits are called  
(a) Atems. (b) Apollos. (c) Trojans.  (d) Centaurs.
54. \_\_\_\_\_ are stony meteorites which have probably been heated to high temperatures.  
(a) Chondrites (b) Carbonaceous chondrites (c) Stony iron meteorites  (d) Achondrites

Chondrites are glassy inclusions which would not survive high temperatures. Achondrites are stony meteorites which lack these. Carbonaceous chondrites also must not be heated to high temperatures.

55. Which method has **not** yet been used in the discovery of a new extrasolar planet?  
 (a) observing the wobble of a star (b) observing changes in pulsar periods  
 (c) observing changes in luminosity of a star (d) observing shifts in spectral lines of stars

Some extrasolar planets have been confirmed by observing occultations, or changes in the luminosity of the star due to the orbiting planet. However, none has yet been discovered this way.

56. Planets with a mass comparable to Jupiter's orbiting close to a star are called  
 (a) hot Jupiters.      (b) brown dwarfs.      (c) pulsars.      (d) white dwarfs.

The logical name is correct. The other choices are all types of stars.

57. The coma of a comet's head can grow up to \_\_\_\_\_ kilometers at perihelion.  
(a) several      (b) hundreds of      (c) thousands of       (d) millions of

Amazingly, the coma can grow to millions of kilometers as the comet approaches the sun.

58. Comet Shoemaker-Levy was photographed breaking up and colliding with  
(a) Earth.      (b) Mars.      (c) the Moon.       (d) Jupiter.

59. Kirkwood gaps correspond to  
(a) depleted regions in the rings of Saturn.  
 (b) radii where few asteroids are found in the Asteroid Belt.  
 (c) asteroid orbital periods which have a simple ratio to Jupiter's period.  
(d) empty regions in the Kuiper Belt.

The Kirkwood gaps are not physically empty spaces, like the gaps in the rings of Saturn. Rather, they are orbital periods which are disfavored due to a resonance with Jupiter's orbital period, which tends to eject asteroids from those orbits.

60. Meteors which break up into several parts upon entering the atmosphere are called  
(a) fireballs.       (b) bolides.      (c) chondrites.      (d) micrometeorites.

61. The largest, brightest stars are unexpected to have planets harboring life because  
(a) they produce too much high-energy radiation.  
(b) they have very small habitable zones.  
 (c) they burn out too fast for life to have time to evolve.  
(d) their planets tend to be in unstable orbits.

The high radiation output increases the size of the habitable zone, but these stars don't last long.

62. The sun's ecosphere includes  
 (a) planets from roughly Venus to Mars.      (b) only the Earth and its moon.  
(c) planets from Earth to Mars.      (d) planets from Earth to Jupiter.

63. A well-known effort to find intelligent life elsewhere in the Universe is or was called  
(a) DS9.      (b) ETU6.       (c) SETI      (d) Cassini.

SETI stands for Search For ExtraTerrestrial Intelligence. This is done by scanning radio signals from space for signs of intelligent communications.

64. A few meteorites found in Antarctic seem to have come from the Moon and even  
(a) Venus.       (b) Mars.      (c) Jupiter.      (d) Mercury.

These meteorites are controversial because some think they show signs that there was once life on Mars.

65. The mass of all the asteroids together is the size of  
(a) the Earth.      (b) several Earths.      (c) Jupiter.       (d) the Moon or smaller.

66. In the 1950s scientists at the University of Chicago synthesized complex organic molecules by passing sparks through a mixture of
- (a) helium and argon.
  - (b) water vapor, methane, and ammonia.
  - (c) water, ethanol, and carbon dioxide.
  - (d) hydrogen peroxide, ozone, and chlorine.

The combinations of water vapor, methane and ammonia was meant to simulate Earth's primordial atmosphere.

67. The gas tail of a comet is created by the effects of the
- (a) nucleus.
  - (b) coma.
  - (c) solar wind.
  - (d) gas jets.

The solar wind blows the tail in a direction which is always away from the Sun.

68. The longest/largest component of a comet is its
- (a) coma.
  - (b) tail.
  - (c) head.
  - (d) nucleus.

The tail can grow to around an astronomical unit in length for some comets, making them (temporarily) the largest things in the solar system.

69. The Tunguska Event was probably **not** caused by
- (a) a comet fragment.
  - (b) a stony meteorite.
  - (c) an iron meteorite.
  - (d) an explosion in the sky.

Either comet fragments or stony meteorites are likely to explode in the sky before impact, as the meteor causing the Tunguska event did. Iron meteorites are more likely to explode on the ground.

70. Life as we know it is based on the chemistry of molecules containing
- (a) hydrogen.
  - (b) oxygen.
  - (c) carbon.
  - (d) nitrogen.
  - (e) silicon.

Carbon forms the long chains needed to form DNA, which stores information in life on Earth.