

Review for Astronomy 5 Midterm and Final

Midterm covers first 70 questions, Final covers all 105.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Which of the following has your "address" in the correct order?
 - A) you, Earth, solar system, Milky Way, Local Supercluster, Local Group
 - B) you, Earth, Local Group, Local Supercluster, solar system, Milky Way
 - C) you, Earth, solar system, Milky Way, Local Group, Local Supercluster
 - D) you, Earth, solar system, Local Group, Local Supercluster, Milky Way
 - E) you, Earth, solar system, Local Group, Milky Way, Local Supercluster

- 2) Which of the following statements about the celestial sphere is *not* true?
 - A) When we look in the sky, the stars all appear to be located on the celestial sphere.
 - B) The celestial sphere does not exist physically.
 - C) Earth is placed at the center of the celestial sphere.
 - D) From any location on Earth, we can see only half the celestial sphere at any one time.
 - E) The "celestial sphere" is just another name for our universe.

- 3) Which of the following statements about the celestial equator is true at *all* latitudes?
 - A) It lies along the band of light we call the Milky Way.
 - B) It extends from your horizon due east, through your zenith, to your horizon due west
 - C) It represents an extension of Earth's equator onto the celestial sphere.
 - D) It extends from your horizon due north, through your zenith, to your horizon due south
 - E) It cuts the dome of your sky exactly in half.

- 4) What is the *ecliptic*?
 - A) the constellations commonly used in astrology to predict the future
 - B) the Sun's daily path across the sky
 - C) the Sun's apparent path along the celestial sphere
 - D) when the Moon passes in front of the Sun
 - E) the Moon's apparent path along the celestial sphere

- 5) Which scientists played a major role in overturning the ancient idea of an Earth-centered universe, and about when?
 - A) Aristotle and Copernicus; about 400 years ago
 - B) Copernicus, Kepler, and Galileo; about 400 years ago
 - C) Aristotle and Plato; about 2,000 years ago
 - D) Huygens and Newton; about 300 years ago
 - E) Newton and Einstein; about 100 years ago

- 6) Which of the following correctly describes the *meridian* in your sky?
 - A) the boundary between the portion of the celestial sphere you can see at any moment and the portion that you cannot see
 - B) a half-circle extending from your horizon due east, through your zenith, to your horizon due west
 - C) a half-circle extending from your horizon due east, through the north celestial pole, to your horizon due west
 - D) the point directly over your head
 - E) a half-circle extending from your horizon due north, through your zenith, to your horizon due south

- 7) How many arcseconds are in 1° ?
- A) 360
 - B) 60
 - C) 3,600
 - D) 100
 - E) 10,000
- 8) What is a *circumpolar* star?
- A) a star that is visible from the Arctic or Antarctic circles
 - B) a star that is close to the south celestial pole
 - C) a star that always remains above your horizon
 - D) a star that makes a daily circle around the celestial sphere
 - E) a star that is close to the north celestial pole
- 9) Which of the following is *not* a phase of the Moon?
- A) full Moon
 - B) first-quarter Moon
 - C) new Moon
 - D) half Moon
 - E) third-quarter Moon
- 10) If the Moon is setting at 6 A.M., the phase of the Moon must be
- A) full.
 - B) third quarter.
 - C) first quarter.
 - D) waning crescent.
 - E) new.
- 11) Which of the following never goes in retrograde motion?
- A) Jupiter
 - B) the Sun
 - C) Venus
 - D) Mars
 - E) Saturn
- 12) Roughly how many stars are in the Milky Way Galaxy?
- A) 1 billion
 - B) 100 billion
 - C) 100 million
 - D) 100 trillion
 - E) 10 billion
- 13) What is an *astronomical unit*?
- A) the average distance from Earth to the Sun
 - B) any basic unit used in astronomy
 - C) the length of time it takes Earth to revolve around the Sun
 - D) the diameter of Earth's orbit around the Sun
 - E) the average speed of Earth around the Sun
- 14) How did Eratosthenes estimate the size of Earth in 240 B.C.?
- A) by observing the duration of a solar eclipse
 - B) by measuring the size of Earth's shadow on the Moon in a lunar eclipse
 - C) by sending fleets of ships around Earth
 - D) by comparing the maximum altitude of the Sun in two cities at different latitudes
 - E) We don't know how he did it since all his writings were destroyed.

- 15) Why did Ptolemy have the planets orbiting Earth on "circles upon circles" in his model of the universe?
- A) to explain why Venus goes through phases as seen from Earth
 - B) to explain why more distant planets take longer to make a circuit through the constellations of the zodiac
 - C) to explain why the Greeks were unable to detect stellar parallax
 - D) to explain the fact that planets sometimes appear to move westward, rather than eastward, relative to the stars in our sky
 - E) to properly account for the varying distances of the planets from Earth
- 16) Where was the Sun in Ptolemy's model of the universe?
- A) between Earth and the Moon's orbit
 - B) at the center
 - C) between the orbits of Venus and Mars
 - D) at the outer edge, beyond Saturn's orbit
 - E) slightly offset from the center
- 17) The controversial book of this famous person, published in 1543 (the year of his death), suggested that Earth and other planets orbit the Sun.
- A) Ptolemy
 - B) Galileo
 - C) Copernicus
 - D) Kepler
 - E) Tycho Brahe
- 18) He discovered that the orbits of planets are ellipses.
- A) Galileo
 - B) Tycho Brahe
 - C) Copernicus
 - D) Kepler
 - E) Ptolemy
- 19) He discovered that Jupiter has moons.
- A) Ptolemy
 - B) Aristotle
 - C) Tycho Brahe
 - D) Galileo
 - E) Kepler
- 20) From Kepler's third law, an asteroid with an orbital period of 8 years lies at an average distance from the Sun equal to
- A) 4 astronomical units.
 - B) 8 astronomical units.
 - C) 16 astronomical units.
 - D) 2 astronomical units.
 - E) It depends on the asteroid's mass.
- 21) What is meant by a *hypothesis*?
- A) a natural phenomenon that requires explanation
 - B) an explanation for a phenomenon that makes a prediction
 - C) a historical theory that has been proved inaccurate
 - D) a tentative understanding of a natural phenomenon
 - E) a pseudoscientific idea
- 22) If your mass is 60 kg on Earth, what would your mass be on the Moon?
- A) 10 lb
 - B) 60 lb
 - C) 50 kg
 - D) 60 kg
 - E) 10 kg
- 23) What would happen if the Space Shuttle were launched with a speed greater than Earth's *escape velocity*?
- A) It would travel away from Earth into the solar system.
 - B) It would be in an unstable orbit.
 - C) It would travel in a higher orbit around Earth.
 - D) It would take less time to reach its bound orbit.
 - E) It would orbit Earth at a faster velocity.

- 24) The movement of a pool ball, after being struck by a cue, is an example of
- A) Newton's third law of motion.
 - B) conservation of momentum.
 - C) the universal law of gravitation.
 - D) Newton's second law of motion.
 - E) Newton's first law of motion.
- 25) The force of gravity is an inverse square law. This means that, if you double the distance between two large masses, the gravitational force between them
- A) weakens by a factor of 2.
 - B) strengthens by a factor of 4.
 - C) also doubles.
 - D) is unaffected.
 - E) weakens by a factor of 4.
- 26) According to the *universal law of gravitation*, if you double the masses of *both* attracting objects, then the gravitational force between them will
- A) not change at all.
 - B) increase by a factor of 2.
 - C) increase by a factor of 4.
 - D) decrease by a factor of 2.
 - E) decrease by a factor of 4.
- 27) The mass of Jupiter can be calculated by
- A) measuring the orbital speed of one of Jupiter's moons.
 - B) knowing the Sun's mass and measuring how Jupiter's speed changes during its elliptical orbit around the Sun.
 - C) measuring the orbital period and distance of one of Jupiter's moons.
 - D) knowing the Sun's mass and measuring the average distance of Jupiter from the Sun.
 - E) measuring the orbital period and distance of Jupiter's orbit around the Sun.
- 28) At which lunar phase(s) are tides most pronounced (e.g., the highest high tides)?
- A) first quarter
 - B) full Moon
 - C) new Moon
 - D) both new and full Moons
 - E) both first and third quarters
- 29) An atom in an *excited state* contains more of what type of energy than the same atom in the *ground state*?
- A) gravitational potential energy
 - B) thermal energy
 - C) kinetic energy
 - D) mass-energy
 - E) electric potential energy
- 30) If a material is highly *opaque*, then it
- A) absorbs most light.
 - B) emits most light.
 - C) scatters most light.
 - D) reflects most light.
 - E) transmits most light.

- 31) The *wavelength* of a wave is
- A) equal to the speed of the wave times the wave's frequency.
 - B) how strong the wave is.
 - C) the distance between a peak of the wave and the next trough.
 - D) the distance between where the wave is emitted and where it is absorbed.
 - E) the distance between two adjacent peaks of the wave.
- 32) How are wavelength, frequency, and energy related for photons of light?
- A) Longer wavelength means lower frequency and higher energy.
 - B) Longer wavelength means higher frequency and lower energy.
 - C) Longer wavelength means lower frequency and lower energy.
 - D) Longer wavelength means higher frequency and higher energy.
 - E) There is no simple relationship because different photons travel at different speeds.
- 33) From lowest energy to highest energy, which of the following correctly orders the different categories of electromagnetic radiation?
- A) radio, infrared, visible light, ultraviolet, X rays, gamma rays
 - B) radio, X rays, visible light, ultraviolet, infrared, gamma rays
 - C) visible light, infrared, X rays, ultraviolet, gamma rays, radio
 - D) gamma rays, X rays, visible light, ultraviolet, infrared, radio
 - E) infrared, visible light, ultraviolet, X rays, gamma rays, radio
- 34) When an atom loses an electron, it becomes
- A) dissociated.
 - B) ionized.
 - C) sublimated.
 - D) a plasma.
 - E) an isotope.
- 35) When an electron in an atom goes from a higher energy state to a lower energy state, the atom
- A) absorbs a photon of a specific frequency.
 - B) can absorb a photon of any frequency.
 - C) absorbs several photons of a specific frequency.
 - D) emits a photon of a specific frequency.
 - E) can emit a photon of any frequency.
- 36) If two objects are the same size but one object is 3 times hotter than the other object, the hotter object emits
- A) 3 times more energy.
 - B) 9 times more energy.
 - C) 81 times more energy.
 - D) 12 times more energy.
 - E) none of the above
- 37) The spectra of most galaxies show redshifts. This means that their spectral lines
- A) have wavelengths that are shorter than normal.
 - B) have a higher intensity in the red part of the spectrum.
 - C) have wavelengths that are longer than normal.
 - D) have normal wavelengths, but absorption of light makes them appear red.
 - E) always are in the red part of the visible spectrum.

- 38) From laboratory measurements, we know that a particular spectral line formed by hydrogen appears at a wavelength of 121.6 nanometers (nm). The spectrum of a particular star shows the same hydrogen line appearing at a wavelength of 121.8 nm. What can we conclude?
- A) The "star" actually is a planet.
 - B) The star is moving away from us.
 - C) The star is moving toward us.
 - D) The star is getting hotter.
 - E) The star is getting colder.
- 39) Telescopes operating at this wavelength must be cooled to observe faint astronomical objects.
- A) extreme infrared
 - B) radio
 - C) visible
 - D) gamma-ray
 - E) X-ray
- 40) Suppose the angular separation of two stars is smaller than the angular resolution of your eyes. How will the stars appear to your eyes?
- A) The two stars will look like a single point of light.
 - B) You will not be able to see these two stars at all.
 - C) The two stars will appear to be touching, looking rather like a small dumbbell.
 - D) You will see only the larger of the two stars, not the smaller one.
 - E) You will see two distinct stars.
- 41) Which of the following statements best describes the two principal advantages of telescopes over eyes?
- A) Telescopes have much more magnification and better angular resolution.
 - B) Telescopes can collect far more light with far better angular resolution.
 - C) Telescopes can see farther without image distortion and can record more accurate colors.
 - D) Telescopes can collect far more light with far greater magnification.
 - E) Telescopes collect more light and are unaffected by twinkling.
- 42) Which of the following is *not* an advantage of the Hubble Space Telescope over ground-based telescopes?
- A) Stars do not twinkle when observed from space.
 - B) It can observe infrared and ultraviolet light, as well as visible light.
 - C) Observers on the ground can use it at any time of day (i.e., not only during their night)
 - D) It is closer to the stars.
 - E) It never has to close because of bad weather.
- 43) In what part of the electromagnetic spectrum do the biggest telescopes on Earth operate?
- A) infrared
 - B) visible
 - C) ultraviolet
 - D) radio
 - E) X-ray
- 44) The core of the Sun is
- A) constantly rising to the surface through convection.
 - B) composed of iron.
 - C) at the same temperature but denser than the surface.
 - D) hotter and denser than the surface.
 - E) at the same temperature and density as the surface.

- 45) What two forces are balanced in what we call *gravitational equilibrium*?
- A) the strong force and kinetic energy
 - B) outward pressure and gravity
 - C) outward pressure and the strong force
 - D) the strong force and gravity
 - E) the electromagnetic force and gravity
- 46) What is the average temperature of the *surface* of the Sun?
- A) 1,000 K
 - B) 1 million K
 - C) 6,000 K
 - D) 10,000 K
 - E) 100,000 K
- 47) Which layer of the Sun do we normally see?
- A) photosphere
 - B) corona
 - C) radiation zone
 - D) convection zone
 - E) chromosphere
- 48) At the center of the Sun, fusion converts hydrogen into
- A) helium, energy, and neutrinos.
 - B) hydrogen compounds.
 - C) radiation and elements like carbon and nitrogen.
 - D) radioactive elements like uranium and plutonium.
 - E) plasma.
- 49) What is *granulation* in the Sun?
- A) lumps of denser material in the Sun
 - B) another name for the way sunspots look on the surface of the Sun
 - C) elements in the Sun other than hydrogen and helium
 - D) dust particles in the Sun that haven't been turned into plasma
 - E) the bubbling pattern on the photosphere produced by the underlying convection
- 50) Approximately, what basic composition are all stars born with?
- A) three-quarters hydrogen, one-quarter helium, no more than 2 percent heavier elements
 - B) 90 percent hydrogen, 10 percent helium, no more than 1 percent heavier elements
 - C) one-quarter hydrogen, three-quarters helium, no more than 2 percent heavier elements
 - D) 98 percent hydrogen, 2 percent helium
 - E) half hydrogen, half helium, no more than 2 percent heavier elements
- 51) Since all stars begin their lives with the same basic composition, what characteristic most determines how they will differ?
- A) location where they are formed
 - B) time they are formed
 - C) luminosity they are formed with
 - D) color they are formed with
 - E) mass they are formed with

- 52) A star's *luminosity* is the
- lifetime of the star.
 - apparent brightness of the star in our sky.
 - total amount of light that the star radiates each second.
 - surface temperature of the star.
 - total amount of light that the star will radiate over its entire lifetime.
- 53) If the distance between us and a star is doubled, with everything else remaining the same, the luminosity
- is decreased by a factor of two, and the apparent brightness is decreased by a factor of two.
 - is decreased by a factor of four, and the apparent brightness is decreased by a factor of four.
 - remains the same, but the apparent brightness is decreased by a factor of two.
 - remains the same, but the apparent brightness is decreased by a factor of four.
 - is decreased by a factor of four, but the apparent brightness remains the same.
- 54) Suppose that you measure the parallax angle for a particular star to be 0.5 arcsecond. The distance to this star is
- 0.5 light-year.
 - 0.5 parsec.
 - 5 light-years.
 - 2 parsecs.
 - 5 parsecs.
- 55) The spectral sequence sorts stars according to
- luminosity.
 - mass.
 - radius.
 - core temperature.
 - surface temperature.
- 56) Which of the following terms is given to a pair of stars that appear to change positions in the sky, indicating that they are orbiting one another?
- double star
 - eclipsing binary
 - spectroscopic binary
 - visual binary
 - none of the above
- 57) On a Hertzsprung–Russell diagram, where would we find stars that are cool and dim?
- upper left
 - lower right
 - upper right
 - lower left
 - center
- 58) On a Hertzsprung–Russell diagram, where on the main sequence would we find stars that have the greatest mass?
- lower left
 - upper right
 - lower right
 - upper left
 - center
- 59) The spectral sequence in order of decreasing temperature is
- OBAFGKM.
 - BAGFKMO.
 - OBAGFKM.
 - ABFGKMO.
 - OFBAGKM.

- 60) Which of the following best describes the axes of a Hertzsprung–Russell (H–R) diagram?
- A) surface temperature on the horizontal axis and luminosity on the vertical axis
 - B) mass on the horizontal axis and luminosity on the vertical axis
 - C) mass on the horizontal axis and stellar age on the vertical axis
 - D) surface temperature on the horizontal axis and radius on the vertical axis
 - E) interior temperature on the horizontal axis and mass on the vertical axis
- 61) The typical size of an interstellar dust grain is
- A) 1 angstrom.
 - B) 1 millimeter.
 - C) 1 micrometer.
 - D) 1 nanometer.
 - E) 1 centimeter.
- 62) If you wanted to observe a molecular cloud, in what wavelength of light would you most likely observe?
- A) ultraviolet
 - B) visible
 - C) infrared
 - D) gamma-ray
 - E) X-ray
- 63) What is the likely reason that we cannot find any examples of the first generation stars?
- A) The first generation stars formed such a long time ago that the light from them has not yet had time to reach us.
 - B) The first generation stars formed with only H and He and therefore have no spectral features.
 - C) The first generation stars are too faint to be visible now.
 - D) We do not know how the first generation stars were formed.
 - E) The first generation stars were all very massive and exploded as supernova.
- 64) What happens to the surface temperature and luminosity when gravity first assembles a protostar from a collapsing cloud?
- A) Its surface temperature and luminosity increase.
 - B) Its surface temperature and luminosity decrease.
 - C) Its surface temperature remains the same and its luminosity decreases.
 - D) Its surface temperature and luminosity remain the same.
 - E) Its surface temperature decreases and its luminosity increases.
- 65) What is the smallest mass a newborn star can have?
- A) about 1/80 the mass of our Sun
 - B) about 1/800 the mass of our Sun
 - C) 80 times the mass of Jupiter
 - D) 800 times the mass of Jupiter
 - E) 8 times the mass of Jupiter
- 66) What happens when a star exhausts its core hydrogen supply?
- A) Its core contracts, but its outer layers expand and the star becomes bigger but cooler and therefore remains at the same brightness.
 - B) Its core contracts, but its outer layers expand and the star becomes bigger and brighter.
 - C) It contracts, becoming smaller and dimmer.
 - D) It contracts, becoming hotter and brighter.
 - E) It expands, becoming bigger but dimmer.

- 67) Compared to the star it evolved from, a red giant is
- A) cooler and brighter.
 - B) the same temperature and brightness.
 - C) hotter and brighter.
 - D) hotter and dimmer.
 - E) cooler and dimmer.
- 68) How many helium nuclei fuse together when making carbon?
- A) 4
 - B) 2
 - C) 3
 - D) varies depending on the reaction
 - E) none of the above
- 69) What is a planetary nebula?
- A) a disk of gas surrounding a protostar that may form into planets
 - B) what is left of the planets around a star after a low-mass star has ended its life
 - C) the expanding shell of gas that is no longer gravitationally held to the remnant of a low-mass star
 - D) the molecular cloud from which protostars form
 - E) the expanding shell of gas that is left when a white dwarf explodes as a supernova
- 70) Which of the following sequences correctly describes the stages of life for a low-mass star?
- A) red giant, protostar, main-sequence, white dwarf
 - B) protostar, main-sequence, white dwarf, red giant
 - C) white dwarf, main-sequence, red giant, protostar
 - D) protostar, red giant, main-sequence, white dwarf
 - E) protostar, main-sequence, red giant, white dwarf
- 71) What happens when the gravity of a massive star is able to overcome *neutron* degeneracy pressure?
- A) The core contracts and becomes a ball of neutrons.
 - B) The core contracts and becomes a white dwarf.
 - C) The star explodes violently, leaving nothing behind.
 - D) Gravity is not able to overcome neutron degeneracy pressure.
 - E) The core contracts and becomes a black hole.
- 72) After a supernova event, what is left behind?
- A) either a white dwarf or a neutron star
 - B) either a neutron star or a black hole
 - C) always a black hole
 - D) always a neutron star
 - E) always a white dwarf
- 73) Why is Supernova 1987A particularly important to astronomers?
- A) It provided the first evidence that neutron stars really exist.
 - B) It was the first supernova detected in nearly 400 years.
 - C) It provided the first evidence that supernovae really occur.
 - D) It occurred only a few dozen light-years from Earth.
 - E) It was the nearest supernova detected in nearly 400 years.

- 74) White dwarfs are so called because
- A) it amplifies the contrast with red giants.
 - B) they are both very hot and very small.
 - C) they are the opposite of black holes.
 - D) they are supported by electron degeneracy pressure.
 - E) they are the end-products of small, low-mass stars.
- 75) What kind of pressure supports a white dwarf?
- A) thermal pressure
 - B) electron degeneracy pressure
 - C) neutron degeneracy pressure
 - D) radiation pressure
 - E) all of the above
- 76) How does a 1.2-solar-mass white dwarf compare to a 1.0-solar-mass white dwarf?
- A) It has a higher surface temperature.
 - B) It has a larger radius.
 - C) It has a lower surface temperature.
 - D) It is supported by neutron, rather than electron, degeneracy pressure.
 - E) It has a smaller radius.
- 77) Which of the following is closest in size (radius) to a white dwarf?
- A) a small city
 - B) the Sun
 - C) a football stadium
 - D) a basketball
 - E) Earth
- 78) Which of the following is closest in size (radius) to a neutron star?
- A) a football stadium
 - B) a basketball
 - C) the Sun
 - D) a city
 - E) Earth
- 79) From a theoretical standpoint, what is a pulsar?
- A) a neutron star or black hole that happens to be in a binary system
 - B) a rapidly rotating neutron star
 - C) a binary system that happens to be aligned so that one star periodically eclipses the other
 - D) a star that alternately expands and contracts in size
 - E) a star that is burning iron in its core
- 80) What is the basic definition of a *black hole*?
- A) a dead galactic nucleus that can only be viewed in infrared
 - B) any object made from dark matter
 - C) any object from which the escape velocity exceeds the speed of light
 - D) a dead star that has faded from view
 - E) any compact mass that emits no light

- 81) Which of the following statements about black holes is *not* true?
- A) If you fell into a black hole, you would experience time to be running normally as you plunged rapidly across the event horizon.
 - B) A black hole is truly a hole in spacetime, through which we could leave the observable universe.
 - C) If we watch a clock fall toward a black hole, we will see it tick slower and slower as it falls nearer to the black hole.
 - D) If you watch someone else fall into a black hole, you will never see him or her cross the event horizon. However, he or she will fade from view as the light he or she emits (or reflects) becomes more and more redshifted.
 - E) If the Sun magically disappeared and was replaced by a black hole of the same mass, Earth would soon be sucked into the black hole.
- 82) If you were to come back to our Solar System in 6 billion years, what might you expect to find?
- A) a white dwarf
 - B) a red giant star
 - C) a rapidly spinning pulsar
 - D) a black hole
 - E) Everything will be pretty much the same as it is now.
- 83) What is the diameter of the disk of the Milky Way?
- A) 100,000 light-years
 - B) 100 light-years
 - C) 1,000,000 light-years
 - D) 10,000 light-years
 - E) 1,000 light-years
- 84) Which of the following comprise the oldest members of the Milky Way?
- A) red giant stars in spiral arms
 - B) Cepheid variables
 - C) O stars
 - D) the Sun and other solar mass stars
 - E) globular clusters
- 85) What produces the 21-cm line that we use to map out the Milky Way Galaxy?
- A) ionized hydrogen
 - B) helium
 - C) molecular hydrogen
 - D) atomic hydrogen
 - E) carbon monoxide
- 86) Approximately how long does it take the Sun to orbit the Milky Way Galaxy?
- A) 23,000 years
 - B) 230,000 years
 - C) 2.3 million years
 - D) 230 million years
 - E) 23 billion years

- 87) Which constellation lies in the direction toward the galactic center?
- A) Orion
 - B) Sagittarius
 - C) Taurus
 - D) Leo
 - E) the Big Dipper
- 88) Compared to spiral galaxies, elliptical galaxies are
- A) bluer and rounder.
 - B) redder and flattened.
 - C) redder and rounder.
 - D) bluer and flattened.
 - E) always much smaller.
- 89) The disk component of a spiral galaxy includes which of the following parts?
- A) bulge
 - B) spiral arms
 - C) globular clusters
 - D) halo
 - E) all of the above
- 90) Why are Cepheid variables important?
- A) Cepheids are a type of young galaxy that helps us understand how galaxies form.
 - B) Cepheids are supermassive stars that are on the verge of becoming supernovae and therefore allow us to choose candidates to watch if we hope to observe a supernova in the near future.
 - C) Cepheids are pulsating variable stars, and their pulsation periods are directly related to their true luminosities. Hence, we can use Cepheids as "standard candles" for distance measurements.
 - D) Cepheid variables are stars that vary in brightness because they harbor a black hole.
- 91) What is *Hubble's law*?
- A) The faster a spiral galaxy's rotation speed, the more luminous it is.
 - B) The recession velocity of a galaxy is inversely proportional to its distance from us.
 - C) The longer the time period between peaks in brightness, the greater the luminosity of the Cepheid variable star.
 - D) The faster a spiral galaxy's rotation speed, the less luminous it is.
 - E) The recession velocity of a galaxy is directly proportional to its distance from us.
- 92) What is the most accurate way to determine the distance to a very distant irregular galaxy?
- A) using a white-dwarf supernova as a standard candle
 - B) main-sequence fitting
 - C) the Tully-Fisher relation
 - D) Hubble's law
 - E) using Cepheid variables
- 93) Based on current estimates of the value of Hubble's constant, how old is the universe?
- A) between 4 and 6 billion years old
 - B) between 8 and 12 billion years old
 - C) between 20 and 40 billion years old
 - D) between 16 and 20 billion years old
 - E) between 12 and 16 billion years old

- 94) I observe a galaxy that is 100 million light-years away: what do I see?
- A) the light from the galaxy as it is today, but it is blueshifted
 - B) the light from the galaxy as it was 100 million years ago and it is redshifted
 - C) the light from the galaxy as it is today, but it is redshifted
 - D) the light from the galaxy as it was 100 million years ago and it is blueshifted
 - E) Nothing: the galaxy lies beyond the cosmological horizon.
- 95) Why should galaxy collisions have been more common in the past than they are today?
- A) Galaxies were more active in the past and therefore would have collided with each other more frequently.
 - B) Galaxies were closer together in the past because the universe was smaller.
 - C) Galaxies were much bigger in the past since they had not contracted completely.
 - D) Galaxy collisions shouldn't have been more common in the past than they are now.
 - E) Galaxies attracted each other more strongly in the past because they were more massive; they had not yet turned most of their mass into stars and light.
- 96) What is a *quasar*?
- A) the extremely bright center of a distant galaxy, thought to be powered by a massive black hole
 - B) a very large galaxy thought to be formed by the merger of several smaller galaxies, typically found in the center of a galaxy cluster
 - C) another name for very bright stars of spectral type O
 - D) a specialized astronomical instrument for observing distant stars
 - E) a starlike object that actually represents a bright patch of gas in the Milky Way
- 97) What is meant by "dark energy"?
- A) any unknown force that opposes gravity
 - B) the energy associated with dark matter through $E=mc^2$
 - C) the total energy in the Universe after the Big Bang but before the first stars
 - D) the agent causing the universal expansion to accelerate
 - E) highly energetic particles that are believed to constitute dark matter
- 98) The distribution of the dark matter in a spiral galaxy is
- A) approximately spherical and about ten times the size of the galaxy halo.
 - B) approximately spherical and about the same size as the galaxy halo.
 - C) flattened in a disk but about ten times larger than the stellar disk.
 - D) flattened in a disk and about the same size as the stellar disk.
 - E) predominantly concentrated in the spiral arms.
- 99) If all the "dark matter" in the Universe were to be, somehow, instantaneously removed, which of the following would *not* happen?
- A) The Milky Way would fly apart.
 - B) The Universe would expand forever.
 - C) Clusters of galaxies would fly apart.
 - D) The Solar System would fly apart.
 - E) all of the above
- 100) What is the evidence for an accelerating universe?
- A) White-dwarf supernovae are the same brightness regardless of redshift.
 - B) White-dwarf supernovae are slightly dimmer than expected for a coasting universe.
 - C) White-dwarf supernovae are slightly brighter than expected for a coasting universe.
 - D) The Andromeda Galaxy is moving away from the Milky Way at an ever-increasing speed.
 - E) There is far more dark matter than visible matter in the universe.

- 101) To date, physicists have investigated the behavior of matter and energy at temperatures as high as those that existed in the universe as far back as _____ after the Big Bang.
- A) 3 minutes
 - B) 300,000 years
 - C) 1 million years
 - D) 10^{-10} second
 - E) 300 years
- 102) What do we mean by *inflation*?
- A) the separation that occurs after two photons collide and create a particle and an antiparticle
 - B) what happened the instant after the Big Bang
 - C) the sudden release of photons when a particle and antiparticle annihilate each other
 - D) the expansion of the universe that we still observe today
 - E) a sudden expansion of the universe after the strong force froze out from the GUT force
- 103) What kinds of atomic nuclei formed during the *era of nucleosynthesis*?
- A) nuclei of all the chemical elements
 - B) only hydrogen
 - C) roughly equal amounts of each of the following: hydrogen, helium, lithium, beryllium, and boron
 - D) only helium
 - E) hydrogen and helium and trace amounts of lithium, beryllium, and boron
- 104) Why did the *era of nuclei* end when the universe was about 300,000 years old?
- A) Neutrinos and electrons were finally able to escape the plasma of the early universe and no longer heated the other particles.
 - B) Photons were finally able to escape the plasma of the early universe and no longer heated the hydrogen and helium ions.
 - C) The universe had expanded and cooled to a temperature of about 3,000 K, cool enough for stable, neutral atoms to form.
 - D) All the free particles had combined to form the nuclei of atoms.
 - E) No theory can explain this.
- 105) Olbers' paradox is an apparently simple question, but its resolution suggests that the universe is finite in age. What is the question?
- A) Can we measure the position and momentum of an electron at the same time?
 - B) How many stars are in the universe?
 - C) What would it be like to ride on a beam of light?
 - D) How does the Sun produce energy?
 - E) Why is the sky dark at night?

Answer Key

Testname: ASTRO5STUDY

- | | | |
|-------|--------|--------|
| 1) C | 51) E | 101) D |
| 2) E | 52) C | 102) E |
| 3) C | 53) D | 103) E |
| 4) C | 54) D | 104) C |
| 5) B | 55) E | 105) E |
| 6) E | 56) D | |
| 7) C | 57) B | |
| 8) C | 58) D | |
| 9) D | 59) A | |
| 10) A | 60) A | |
| 11) B | 61) C | |
| 12) B | 62) C | |
| 13) A | 63) E | |
| 14) D | 64) A | |
| 15) D | 65) C | |
| 16) C | 66) B | |
| 17) C | 67) A | |
| 18) D | 68) C | |
| 19) D | 69) C | |
| 20) A | 70) E | |
| 21) B | 71) E | |
| 22) D | 72) B | |
| 23) A | 73) E | |
| 24) D | 74) B | |
| 25) E | 75) B | |
| 26) C | 76) E | |
| 27) C | 77) E | |
| 28) D | 78) D | |
| 29) E | 79) B | |
| 30) A | 80) C | |
| 31) E | 81) E | |
| 32) C | 82) A | |
| 33) A | 83) A | |
| 34) B | 84) E | |
| 35) D | 85) D | |
| 36) C | 86) D | |
| 37) C | 87) B | |
| 38) B | 88) C | |
| 39) A | 89) B | |
| 40) A | 90) C | |
| 41) B | 91) E | |
| 42) D | 92) A | |
| 43) D | 93) E | |
| 44) D | 94) B | |
| 45) B | 95) B | |
| 46) C | 96) A | |
| 47) A | 97) D | |
| 48) A | 98) A | |
| 49) E | 99) D | |
| 50) A | 100) B | |