*Online Astronomy 162* *Final Exam*

**Name:** Answer Key

**Student ID:** White Version

**Section:**

Each question has one best answer. There are 65 questions with a total of 75 points.

**1.** [1pt] 'Double quasars', where two quasars close together are observed to have exactly the same characteristics are caused by _____ ?

(A) gravitational lenses
B) the Doppler effect
C) a parallax effect
D) binary quasar systems similar to binary star sytems
E) the collision of active galactic nuclei

**2.** [1pt] The "life as we know it" definition implies that extraterrestrial life is based on molecules containing

A) hydrogen.
(B) carbon.
C) silicon.
D) nitrogen.
E) oxygen.

**3.** [1pt] The basic building blocks of proteins have been found in meteorites. What are these building blocks called?

A) esters
B) nucleic bases
C) complex carbohydrates
(D) amino acids
E) glycols

**4.** [1pt] What is the 'cosmological principle'?

A) The Universe is the same at all places and all times
(B) The Universe is the same at all places
C) No part of the Universe looks like any other part
D) The Universe is the same at all times
E) The Universe is the same at all times, but not at all places

**5.** [1pt] The large (60,000 ly radius) sphere of older stars and globular clusters around the central region of the Galaxy is the

A) disk.
B) nuclear bulge.
(C) halo.
D) galactic nucleus.

**6.** [1pt] Which of the four interactions of nature is most important in cosmology?

A) strong force
B) all are of the same importance
C) weak force
(D) gravity
E) electromagnetic force

**7.** [1pt] 'Fuzz' and the spectra of stars have been observed around quasars. This is important because it suggests strongly that _____ ?

A) quasars really are stars, though of a very strange sort
B) quasars are really Seyfert Galaxies
(C) quasars appear to be embedded in galaxies of some kind
D) the redshift is being caused by a large gravitational field
E) quasars are really much closer than originally thought

**8.** [1pt] The observation that some quasars vary their light output on timescales as short as days is important because it implies that _____ ?

(A) they must have a very compact energy source
B) they cannot be stars
C) they must contain variable stars
D) their redshifts cannot be a gravitational effect
E) they must be very close to us

**9.** [1pt] The energy output of a bright quasar is typically equivalent to _____ .

A) 100 stars like our Sun
(B) 1000 bright normal galaxies
C) our Milky Way galaxy
D) the Sun
E) a supernova

**10.** [1pt] Which of the following statements is true of giant elliptical galaxies?

A) They usually contain faint traces of spiral arms under close observation.
B) They contain no globular clusters
C) Their light is dominated by hot blue stars.
D) They contain prominent dust lanes.
(E) Their light is dominated by Population II stars.

**11.** [1pt] Which of the following has NOT commonly been used to determine extragalactic distance scales?

A) planetary nebulae
B) globular clusters
(C) RR Lyra variables
D) Cepheid variables
E) type I supernovae

**12.** [1pt] The cluster of galaxies to which the Milky Way belongs is called _____ ?

A) the Galactic Hood
B) the Coma Group
C) the Local Group
D) the Proximate Association
E) the Virgo Group

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**13.** [1pt] The nearest galaxy to us in the Local Group that isn't a dwarf elliptical is _____ ?

A) M81
B) The Large Magellanic Cloud
C) NGC 205
D) M33
E) Andromedae

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**14.** [5pt] Match each statement with the appropriate object, and enter the associated letter.

D Spiral galaxies with bright nuclei and regions of gas in turbulent motion.

B Luminous galaxies that have non-thermal spectra.

E Very intense quasars with rapidly varying brightness.

C Galaxies that emit much of their energy in radiowave photons.

A Distant objects that show very red shifted spectral lines.

A. quasars
B. active galaxies
C. radio galaxies
D. Seyfert galaxies
E. BL Lac objects

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**15.** [1pt] The _____ Catalog of objects in the sky grew from a compilation of 'fuzzy' objects designed to keep comet watchers from mistaking these objects for comets.

A) Halley
B) New General
C) Hubble
D) New Galactic
E) Messier

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**16.** [1pt] In 1929, Hubble announced that a galaxy's distance from us is directly proportional to its

A) type.
B) size.
C) proper motion.
D) redshift.
E) mass.

**17.** [1pt] The length of time light from a galaxy has been traveling through space in order to reach us is the galaxy's

A) look-back time.
B) set-back time.
C) effective age.
D) Tully-Fisher constant.

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**18.** [1pt] Many globular clusters are found in the _____ of our galaxy?

A) halo
B) spiral arms and central bulge
C) H II regions
D) disk
E) spiral arms

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**19.** [1pt] In the northern hemisphere the 'winter Milky Way' is less prominent in our sky than the 'summer Milky Way' because _____ ?

A) the summer Milky Way is composed of Population II stars, which are brighter
B) the dust clouds in the disk of the galaxy cause more obscuration in the winter than the summer
C) the stars in the summer Milky Way are closer to us than those in the winter Milky Way
D) the Sun is closer to the outer edge of the galaxy than the center
E) it is made of variable stars that are brighter in the summer

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**20.** [1pt] The earliest stars that formed in the galaxy were _____ ?

A) composed almost entirely of helium
B) metal rich
C) devoid of helium
D) metal poor
E) part of present Population I

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**21.** [1pt] Nebulae with hot central stars that ionize the nebula with their UV radiation are called _____ nebulae?

A) emission
B) ultraviolet
C) dark
D) reflecting
E) absorption

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**22.** [1pt] The primary source of 'metals' in Population I stars is probably _____ that have enriched the galaxy in heavy elements.

A) supernovae
B) planetary nebulae
C) novae
D) T-Tauri winds
E) pulsars

**23.** [1pt] The force holding the nuclei of atoms together is the

A) gravitational force.
B) strong force.
C) electromagnetic force.
D) weak force.

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**24.** [1pt] A universe that has not expanded uniformly, but for some very short period in its history expanded rapidly, is called

A) open.
B) inflationary.
C) oscillating.
D) closed.
E) flat.

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**25.** [1pt] One success of the inflationary theory of the Universe is that it can explain why the Universe appears to be

A) closed.
B) undergoing a phase transition.
C) flat.
D) open.
E) oscillating.

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**26.** [1pt] Theories that attempt to explain all known forces as different manifestations of a single, fundamental force are known as

A) Grand Unified Theories.
B) Inflationary theories.
C) Supersymmetric theories.
D) Relative theories.

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**27.** [1pt] The notion that the Universe had an instant when it began is implied by its

A) uniform optical brightness.
B) expansion.
C) iron abundance.
D) homogeneity.
E) infiniteness.

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**28.** [1pt] The strongest non-thermal radio source in the Milky Way galaxy is _____ ?

A) Sagittarius A
B) Cygnus X-1
C) Taurus M1
D) Orion B
E) RR-Lyra

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**29.** [1pt] To determine if gravitational effects can be strong enough to stop the expansion of the Universe it is necessary to know the Universe's

A) overall size.
B) average redshift factor.
C) matter/photon ratio.
D) average mass density.
E) material composition.

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**30.** [1pt] The discovery that some clusters of galaxies do not have enough visible mass to maintain the structure of the cluster has become known as

A) the cluster paradox.
B) the missing mass problem.
C) Olbers's paradox.
D) the neutrino problem.
E) the dark matter defect.

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**31.** [1pt] The oldest objects we can reliably date are

A) H II regions.
B) pulsars.
C) iron meteorites.
D) Cepheid variables.
E) globular clusters.

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**32.** [1pt] A Universe in which composition and density are the same everywhere at a given time is

A) open.
B) homogenous.
C) closed.
D) isotropic.
E) perfectly cosmological.

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**33.** [1pt] The cosmic background radiation, which permeates the Universe, was predicted as an outcome of the

A) Big Bang theory.
B) General Theory of Relativity.
C) supermassive supernova theory.
D) steady-state theory.

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**34.** [1pt] Quasars appear to be

A) long-lived objects, unchanged since the beginning of the Universe.
B) extremely rare in galaxy clusters.
C) a particularly active phase in the history of a galaxy.
D) all at about the same distance.

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**35.** [1pt] Which of the following are primary distance indicators?

A) gamma ray bursts
B) Cepheid variables
C) neutron stars
D) Type Ia supernovae

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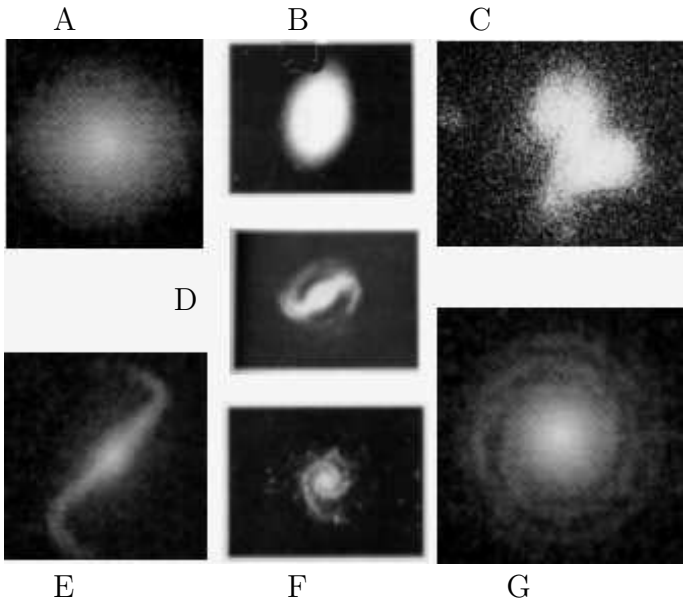
**36.** [1pt] The velocity of a galaxy, over and above its velocity due to the expansion of the Universe, caused by its gravitational interaction with other masses is called its

A) orbital motion.
B) tangential motion.
C) peculiar motion.
D) irregular motion.
E) proper motion.

**37.** [7pt] Match the Hubble classification of the galaxy with the picture. (For each type below, enter the letter for the corresponding picture.)




A E0

C Irregular

F Sc

B E3

D SBa

E SBc

G Sa

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**38.** [1pt] Searches for signals from intelligent extraterrestrial life have been conducted mainly at

A) optical wavelengths.
B) ultraviolet wavelengths.
C) infrared wavelengths.
D) radio wavelengths.

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**39.** [1pt] We describe galaxies primarily by their

A) Hubble type.
B) brightness coefficient.
C) UBV magnitude.
D) NGC-class.
E) M-class.

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**40.** [1pt] Galaxies that radiate strongly at radio and x-ray wavelengths are called

A) transition galaxies.
B) active galaxies.
C) spiral galaxies.
D) irregular galaxies.
E) elliptical galaxies.

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**41.** [1pt] Which of the following is a major source of radio continuum radiation from celestial sources outside the solar system?

A) inversion
B) hydrogen spin flip
C) molecular rotation
D) synchrotron radiation

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**42.** [1pt] While studying the distribution of globular clusters, Harlow Shapley discovered that we are not in the

A) center of the Galaxy.
B) galactic disk.
C) galactic halo.
D) galactic corona.

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**43.** [1pt] Stars in the galactic halo are generally

A) very young.
B) very massive.
C) very old.
D) accompanied by clouds of gas and dust.

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**44.** [1pt] Most of the mass of the Milky Way Galaxy is detectable

A) in no part of the electromagnetic spectrum.
B) in the infrared.
C) in x-rays.
D) at radio wavelengths.
E) in visible light.

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**45.** [1pt] To trace out the spiral structure of our Galaxy we should look at

A) very young objects.
B) very old objects.
C) neutron stars.
D) dark nebulae.

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**46.** [1pt] The critical density of the Universe is defined as _____ ?

A) the density just sufficient to cause galaxies to begin to form
B) the density that is just sufficient to cause the Universe to collapse back on itself
C) the density that is just enough to stop the expansion after infinite time
D) the initial density necessary to trigger the Big Bang
E) the density at which superclusters of galaxies begin to form

**47.** [1pt] The volume around a star in which conditions may be suitable for life is called the

A) habitable zone.
B) biosphere.
C) photon sphere.
D) living space.

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**48.** [1pt] A well-known effort to find intelligent life elsewhere in the Universe is or was called

A) DS9.
B) Project Contact.
C) ETU6.
D) SETI.

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**49.** [1pt] The cosmological red shift of the light from very distant galaxies is caused by _____ .

A) a gravitational red shift due to the galaxy's mass
B) the rotational motion within the Universe
C) absorption of blue light by interstellar dust
D) the expansion of space and the stretching of a photon's wavelength in that expanding space
E) a Doppler shift and the motion of a galaxy away from a stationary observer

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**50.** [1pt] The cosmic background radiation is left over from the instant when the Universe became

A) opaque.
B) hot.
C) transparent.
D) solid.
E) cold.

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**51.** [1pt] Astronomers discovered quasars while trying to correlate optical objects in the sky with

A) infrared sources.
B) cosmic ray sources.
C) x-ray sources.
D) radio sources.

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**52.** [1pt] Which spacecraft currently leaving the Solar System carry a selection of music from around the world in the event they are ever found by an extraterrestrial civilization?

A) the Pioneers
B) the Rangers
C) the Mariners
D) the Challengers
E) the Voyagers

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**53.** [1pt] A circular image produced by gravitational lensing is called a(n)

A) relativistic shadow.
B) secondary focus.
C) Hawking circle.
D) Einstein ring.

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**54.** [1pt] The multiple images seen in a gravitationally lensed quasar have all but which of the following?

A) the same redshift
B) the same light path through space
C) the same spectra
D) the same distance

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**55.** [1pt] Classification of spiral galaxies into subtypes is based on

A) the presence of a nuclear bulge.
B) grouping of stars into globular clusters.
C) how tightly wound the spiral arms are.
D) the size of the dust lane.
E) the number of stars contained in the galaxy.

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**56.** [1pt] The most distant quasar yet observed is moving away from us at about _____ percent of the speed of light?

A) 94
B) 15
C) 7
D) 120
E) 41

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**57.** [1pt] One surprising result of Hubble Space Telescope observations of quasars is that

A) quasars can be found in both spiral and elliptical galaxies.
B) quasars typically have luminosities lower than those typical of AGNs.
C) quasars are local objects with measurable parallax.
D) most quasars are in binary or multiple quasar systems.

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**58.** [1pt] In the several spacecraft leaving the Solar System that carry information intended for any extraterrestrial civilization that should find the spacecraft, how is the time of the spacecraft launch included in the information?

A) by showing a series of solar eclipses with the time in between recorded
B) by including a long half-life decaying radioactive source
C) by showing the directions and periods of nearby pulsars
D) by including a long-running atomic clock
E) by recording the times of several recent supernova events

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**59.** [1pt] What does the Drake Equation calculate?

A) The probability for life to evolve on a planet.
B) The probability that a star will have planets.
C) The number of galaxies in a cluster.
D) The age of the universe.
E) The number of communicative civilizations in a galaxy.

**60.** [1pt] What part of the solar system lies within the Habitable Zone?

A) Planets from Venus to the Earth.
B) Only Earth and its Moon.
C) Planets from the Earth to Jupiter.
D) Planets from Venus to Mars.
E) Planets from the Earth to Mars.

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**61.** [1pt] An explanation for the quasars found nearby is that they are being fueled by

A) collapsing galaxies.
B) black holes.
C) nucleosynthesis.
D) gas from another, interacting galaxy.
E) clusters interacting.

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**62.** [1pt] The largest, brightest stars are unexpected to have planets harboring life because

A) their planets tend to be in unstable orbits.
B) they have very small habitable zones.
C) they produce too much high energy radiation.
D) they burn out too fast for life to have time to evolve.
E) it is improbable life evolved anywhere but Earth.

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**63.** [1pt] The core of the galaxy lies in the direction of the constellation _____ ?

A) Cygnus
B) Sagittarius
C) Orion
D) Leo
E) Taurus

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**64.** [1pt] The spectra of quasars were not interpreted properly at first because they have _____ ?

A) blue shifts larger than any known star
B) no lines in the visible spectrum
C) images that look very different from stars
D) very large redshifts
E) only absorption and no emission lines

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**65.** [1pt] Quasars and the cosmic background radiation are the strongest evidence against the

A) steady-state theory.
B) General Theory of Relativity.
C) Big Bang theory.
D) supermassive supernova theory.