

Name:

Answer Key

Student ID:

Pink Version

Section:

Each question has one best answer. There are 60 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 systems
- E) the collision of active galactic nuclei

2. [1pt] The cosmological red shift of the light from very distant galaxies is caused by _____ .

- A) absorption of blue light by interstellar dust
- B) the rotational motion within the Universe
- C) a gravitational red shift due to the galaxy's mass
- 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

3. [1pt] Which of the four interactions of nature is most important in cosmology?

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

4. [1pt] 'Fuzz' and the spectra of stars have been observed around quasars. This is important because it suggests strongly that _____ ?

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

5. [1pt] The most distant quasar yet observed is moving away from us at about _____ percent of the speed of light?

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

6. [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) Their light is dominated by Population II stars.
- C) They contain no globular clusters
- D) They contain prominent dust lanes.
- E) Their light is dominated by hot blue stars.

7. [1pt] Which of the following has NOT commonly been used to determine extragalactic distance scales?

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

8. [1pt] The nearest galaxy to us in the Local Group that isn't a dwarf elliptical is _____ ?

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

9. [1pt] The core of the galaxy lies in the direction of the constellation _____ ?

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

10. [1pt] The earliest stars that formed in the galaxy were _____ ?

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

11. [1pt] The primary source of 'metals' in Population I stars is probably _____ that have enriched the galaxy in heavy elements.

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

12. [1pt] The strongest non-thermal radio source in the Milky Way galaxy is _____ ?

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

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

14. [1pt] The force holding the nuclei of atoms together is the

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

15. [1pt] Theories that attempt to explain all known forces as different manifestations of a single, fundamental force are known as

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

16. [1pt] The oldest objects we can reliably date are

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

17. [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.

18. [1pt] The cosmic background radiation, which permeates the Universe, was predicted as an outcome of the

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

19. [1pt] The cosmic background radiation is left over from the instant when the Universe became

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

20. [1pt] An explanation for the quasars found nearby is that they are being fueled by

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

21. [1pt] One surprising result of Hubble Space Telescope observations of quasars is that

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

22. [1pt] The multiple images seen in a gravitationally lensed quasar have all but which of the following?

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

23. [1pt] Quasars appear to be

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

24. [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) Tully-Fisher constant.
- D) effective age.

25. [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) peculiar motion.
- B) irregular motion.
- C) tangential motion.
- D) orbital motion.
- E) proper motion.

26. [1pt] We describe galaxies primarily by their

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

27. [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.

28. [1pt] Because molecular hydrogen is difficult to detect, astronomers map the distribution of molecular material in our Galaxy with observations of the more easily detectable molecule

- A) CO.
- B) H3+.
- C) NH3.
- D) H2CO.

29. [1pt] A heavily-studied giant molecular cloud is in

- A) Orion.
- B) a distant quasar.
- C) our solar system.
- D) Ursa Major.

30. [1pt] Which of the following is a major source of radio continuum radiation from celestial sources outside the solar system?

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

31. [1pt] While studying the distribution of globular clusters, Harlow Shapley discovered that we are not in the

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

32. [1pt] Stars in the galactic halo are generally

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

33. [1pt] Most of the mass of the Milky Way Galaxy is detectable

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

34. [1pt] If, after a supernova, the stellar core is less than two solar masses, the result will probably be a

- A) white dwarf.
- B) black hole.
- C) neutron star.
- D) black dwarf.
- E) supermassive star.

35. [1pt] The imaginary boundary around a rotating black hole at which no particles can remain at rest is the

- A) singularity.
- B) Schwarzschild radius.
- C) stationary limit.
- D) event horizon.
- E) ergosphere.

36. [1pt] Mini black holes may be left over from

- A) supernovae.
- B) stellar collisions.
- C) the beginning of the Universe.
- D) novae.

37. [1pt] The model that describes pulsars as beams of radio waves from rotating neutron stars is the

- A) flashlight model.
- B) neutral pulse model.
- C) searchlight model.
- D) neutron pulsed model.
- E) lighthouse model.

38. [1pt] Pulsars with very short, very stable periods of rotation are called

- A) fast pulsars.
- B) early pulsars.
- C) quick pulsars.
- D) millisecond pulsars.
- E) microsecond pulsars.

39. [1pt] Type II supernovae occur only in

- A) double-star systems.
- B) white dwarfs.
- C) elliptical galaxies.
- D) red supergiant stars.
- E) globular clusters.

40. [1pt] When the core of a massive star collapses, rebounds, and explodes into a supernova, it picks up much of its energy from the outflow of

- A) neutral atoms.
- B) photons.
- C) positions.
- D) ions.
- E) neutrinos.

41. [1pt] After a star enters its red giant phase its core will heat up enough for the triple-alpha process to begin to produce

- A) oxygen.
- B) hydrogen.
- C) nitrogen.
- D) helium.
- E) carbon.

42. [1pt] A nova involves material from a companion star falling on a

- A) white dwarf.
- B) protostar.
- C) dust cloud.
- D) red giant.
- E) main-sequence star.

43. [1pt] An electrically neutral gas composed of separate ions and electrons is a(n)

- A) plasma.
- B) dust cloud.
- C) torus.
- D) flux tube.
- E) element.

44. [1pt] During most of its lifetime a dwarf star, on the main sequence of a temperature-luminosity diagram, will

- A) move upward.
- B) move to the right.
- C) stay in about the same place.
- D) move downward.
- E) move to the left.

45. [1pt] The fusion process which produces energy in most stars forms helium nuclei from the nuclei of

- A) iron.
- B) hydrogen.
- C) oxygen.
- D) nitrogen.
- E) carbon.

46. [1pt] The main value in the study of binary stars is the ability it gives us to determine stellar

- A) sizes.
- B) periods.
- C) masses.
- D) colors.
- E) spectra.

47. [1pt] Star clusters made of many thousands of older stars are called

- A) open clusters.
- B) globular clusters.
- C) Population II areas.
- D) Population I areas.
- E) star clusters.

48. [1pt] The magnitude a star would have if it were at a standard distance of 10 parsecs is its

- A) luminosity.
- B) standard magnitude.
- C) relative luminosity.
- D) absolute magnitude.
- E) apparent magnitude.

49. [1pt] A star that is 40 parsecs from the Sun would, if moved to a distance of 10 parsecs, be

- A) 16 times dimmer.
- B) 4 magnitudes brighter.
- C) 16 times brighter.
- D) 4 times brighter.
- E) 4 times dimmer.

50. [1pt] When a solid body is heated to high temperatures the result is a(n)

- A) absorption spectrum.
- B) emission spectrum.
- C) absorption line.
- D) emission line.
- E) continuous spectrum.

51. [1pt] Our Sun is of spectral type

- A) M.
- B) K.
- C) O.
- D) G.
- E) B.

52. [1pt] Magnetic storms on the Earth are caused by

- A) the solar corona.
- B) the solar photosphere.
- C) the solar chromosphere.
- D) solar flares.

53. [1pt] The orientation of the Sun's magnetic field changes, repeating a full cycle every

- A) 11 years.
- B) 33 years.
- C) year.
- D) 22 years.

54. [1pt] The wavelength peak of the Sun's radiation is in the middle of the

- A) visible spectrum.
- B) ultraviolet region.
- C) radio spectrum.
- D) infrared region.
- E) x-ray region.

55. [1pt] The solar chromosphere is composed of relatively small rising jets of gas called

- A) granules.
- B) spicules.
- C) sphericules.
- D) flares.
- E) supergranulations.

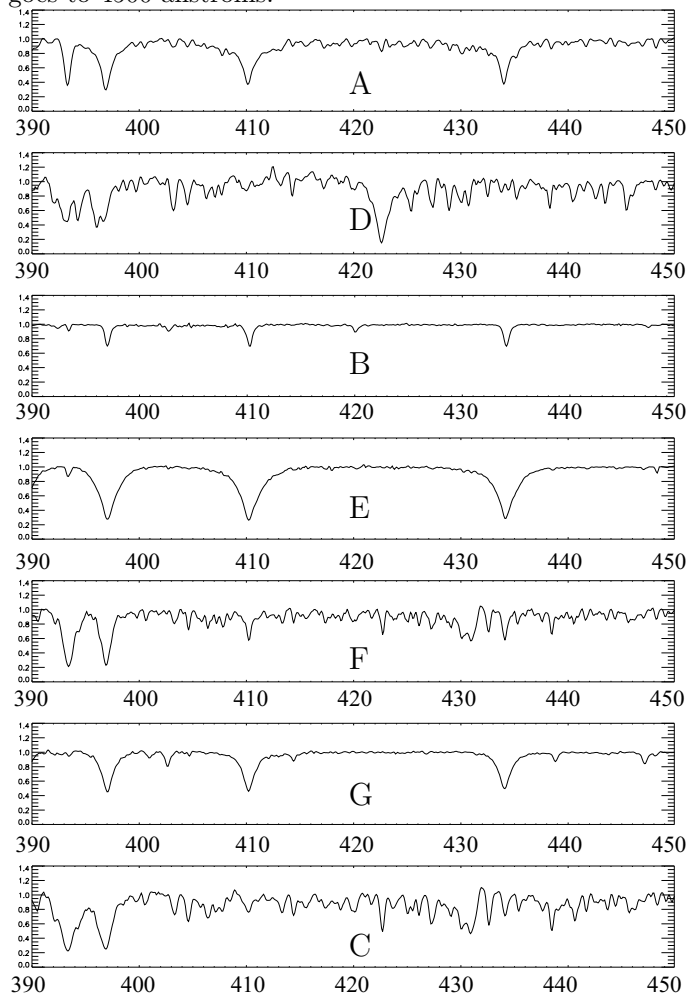
56. [5pt] Match each statement with the appropriate object, and enter the associated letter.

- B rapidly varying, intense quasars A. long-period variables
- A red giant variables such as Mira, which vary slowly in brightness. B. BL Lacterids
- E have a period-luminosity relation which has made them a primary distance indicator. C. intrinsic variables
- C have a changing light curve due to variations in brightness of a single star. D. RR Lyrae variables
- D have very short regular periods and the same absolute magnitude. E. Cepheid variables

57. [5pt] Match each statement with the appropriate object, and enter the associated letter.

- D tremendous explosion ejecting particles and radiation from a region around a sunspot. A. prominence
- B area of the sun appearing relatively dark in visible light. B. sunspot
- E a less dark region surrounding a sunspot. C. filament
- A a filament projecting outside the solar limb. D. solar flare
- C dark thread crossing the sun in the vicinity of a sunspot. E. penumbra

58. [1pt] Digital spectra of each spectral class are shown. Select the correct order of the digital spectra from hottest to coldest. DATA: blue hydrogen lines are at 3970, 4101 and 4471 *angstroms*; calcium II (an ionized heavy metal lines are at 3933 and 3968 *angstroms*. The scale starts at 3900 *angstroms* and goes to 4500 *angstroms*.



- A) ECGBDAF
- B) BGFAECD
- C) BGEAFCD
- D) CFGDAEB
- E) AGEFCDB
- F) GEBDFAC

59. [4pt] Identify the spectral type (OBAFGKM) of the given spectra shown above.

- O Spectrum B
- A Spectrum E
- B Spectrum G
- M Spectrum D

60. [5pt] Match each statement with the appropriate object, and enter the associated letter.

- A Very intense quasars with rapidly varying brightness. A. BL Lac objects
- D Spiral galaxies with bright nuclei and regions of gas in turbulent motion. B. radio galaxies
- E Luminous galaxies that have non-thermal spectra. C. quasars
- B Galaxies that emit much of their energy in radio wave photons. D. Seyfert galaxies
- C Distant objects that show very red shifted spectral lines. E. active galaxies