

Name:

Answer Key

Student ID:

Yellow Version

Section:

Each question has one best answer. There are 60 questions with a total of 75 points.

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

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

2. [1pt] If, after a supernova, the stellar core is less than two solar masses, the result will probably be a

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

3. [1pt] If electrons are added to or removed from a neutral atom the atom is said to be

- A) a proto-atom.
- B) doubly neutral.
- C) ionized.
- D) nuclear.
- E) electronic.

4. [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.

5. [1pt] Many globular clusters are found in the \_\_\_\_\_ of our galaxy?

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

6. [5pt] Match each statement with the appropriate object, and enter the associated letter.

A the light we receive from the Sun comes from this layer. A. photosphere

E the sun produces all of its energy in this layer. B. solar wind

B this extension of the solar atmosphere extends at least to Neptune. C. chromosphere

D a layer of the solar atmosphere so hot it emits mostly X-rays D. corona

C the spiky atmospheric layer just above the visible layer. E. core

7. [1pt] Classification of spiral galaxies into subtypes is based on

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

8. [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.

9. [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

10. [1pt] Mini black holes may be left over from

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

11. [1pt] Magnetic storms on the Earth are caused by

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

---

12. [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) matter/photon ratio.
- C) average redshift factor.
- D) material composition.
- E) average mass density.

---

13. [1pt] A heavily-studied giant molecular cloud is in

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

---

14. [1pt] Star clusters with irregular shapes and containing stars with relatively large amounts of heavier elements are called

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

---

15. [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.

---

16. [1pt] About 94 percent of the nuclei in the outer parts of the Sun are

- A) gas.
- B) helium.
- C) hydrogen.
- D) heavy elements.

17. [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

---

18. [1pt] 'Double quasars', where two quasars close together are observed to have exactly the same characteristics are caused by \_\_\_\_\_ ?

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

---

19. [5pt] Match each statement with the appropriate object, and enter the associated letter.

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

---

20. [1pt] The energy output of a bright quasar is typically equivalent to \_\_\_\_\_ .

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

---

21. [1pt] In 1929, Hubble announced that a galaxy's distance from us is directly proportional to its

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

22. [1pt] Which of the four interactions of nature is most important in cosmology?

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

---

23. [1pt] The cosmic background radiation, which permeates the Universe, was predicted as an outcome of the

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

---

24. [1pt] Quasars and the cosmic background radiation are the strongest evidence against the

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

---

25. [1pt] What are 'top down' theories of galaxy formation?

- A) Theories in which all galaxies first form as clusters of spiral galaxies and some of these evolve into elliptical galaxies
- B) Theories in which galaxies form and then conglomerate to form clusters and superclusters of galaxies
- C) Theories in which clusters of giant elliptical galaxies are torn apart by supernova explosions to form smaller galaxies
- D) Theories in which superclusters of galaxies form and then fragment to make galaxies
- E) Theories in which all galaxies first form as clusters of giant elliptical galaxies

---

26. [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) proper motion.
- C) orbital motion.
- D) irregular motion.
- E) tangential motion.

---

27. [1pt] The length of time light from a galaxy has been traveling through space in order to reach us is the galaxy's

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

28. [1pt] Oscillating stars were ruled out as an explanation for pulsars because they would not have the correct

- A) energy.
- B) wavelength.
- C) period.
- D) magnitude.
- E) intensity.

---

29. [1pt] Pulsars with very short, very stable periods of rotation are called

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

---

30. [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) positions.
- C) neutrinos.
- D) ions.
- E) photons.

---

31. [1pt] A star that is 100 times fainter than another star at the same distance will be

- A) 5 magnitudes dimmer.
- B) 3 magnitudes dimmer.
- C) 10 magnitudes dimmer.
- D) 2.5 magnitudes dimmer.
- E) 1 magnitude dimmer.

---

32. [1pt] As the solar atmosphere expands outward into interplanetary space it becomes the

- A) core.
- B) photosphere.
- C) corona.
- D) chromosphere.
- E) solar wind.

---

33. [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) H<sub>2</sub>CO.
- B) H<sub>3</sub><sup>+</sup>.
- C) NH<sub>3</sub>.
- D) CO.

34. [1pt] The primary source of 'metals' in Population I stars is probably \_\_\_\_\_ that have enriched the galaxy in heavy elements.

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

---

35. [1pt] The cluster of galaxies to which the Milky Way belongs is called \_\_\_\_\_ ?

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

---

36. [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

---

37. [1pt] A nova involves material from a companion star falling on a

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

---

38. [1pt] What happen to most of the extra mass of a star that becomes a white dwarf?

- A) There is no extra mass - it all goes into the white dwarf.
- B) It remains in a shell close by the white dwarf.
- C) The gravity of the white dwarf pulls it into a ring like Saturn's.
- D) It disperses into interstellar space, mixing with other interstellar matter.

39. [1pt] In the northern hemisphere the 'winter Milky Way' is less prominent in our sky than the 'summer Milky Way' because \_\_\_\_\_ ?

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

---

40. [1pt] The spectra of quasars were not interpreted properly at first because they have \_\_\_\_\_ ?

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

---

41. [1pt] Astronomers discovered quasars while trying to correlate optical objects in the sky with

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

---

42. [1pt] The rule describing the relationship between the total radiant energy emitted by a blackbody to its temperature is

- A) the quantum theory.
- B) the Stefan-Boltzmann law.
- C) the blackbody rule.
- D) Planck's law.
- E) the Wien displacement law.

---

43. [1pt] The oldest objects we can reliably date are

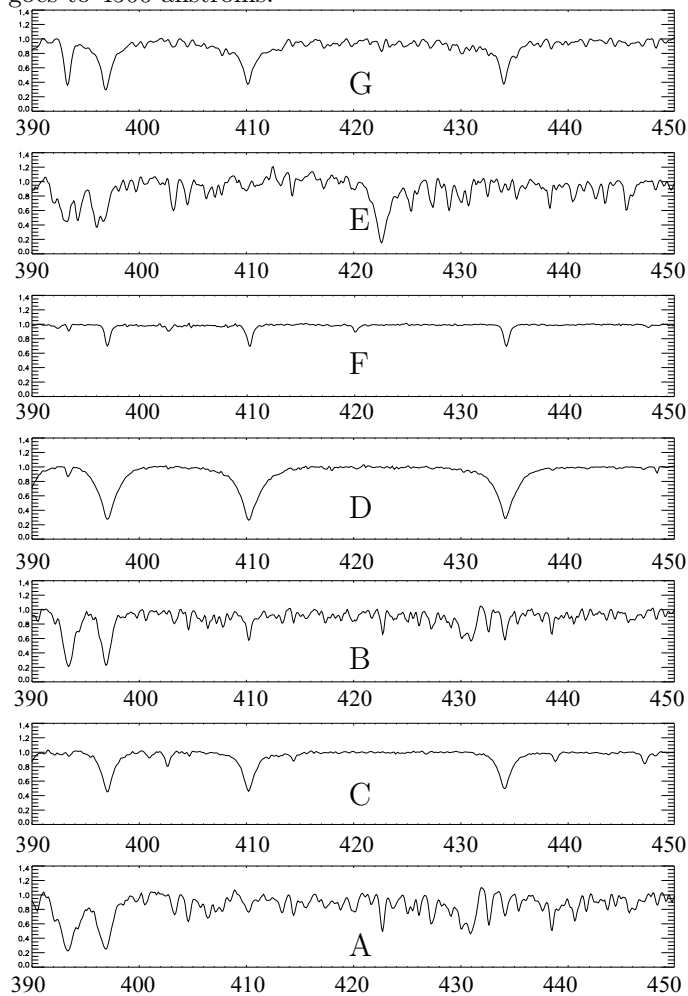
- A) pulsars.
- B) globular clusters.
- C) iron meteorites.
- D) H II regions.
- E) Cepheid variables.

---

44. [1pt] A stellar sized hot body that derives its energy from free-falling gravitational collapse is a

- A) protostar.
- B) white dwarf.
- C) main-sequence star.
- D) brown dwarf.
- E) circumstellar disk.

45. [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) AGDFCBE
- B) FCBGDAE
- C) FCDGBAE
- D) GEDCBAF
- E) BDAEGCF
- F) DAFCEBG

46. [4pt] Identify the spectral type (OBAFGKM) of the given spectra shown above.

- B Spectrum C
- A Spectrum D
- M Spectrum E
- O Spectrum F

47. [1pt] We describe galaxies primarily by their

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

48. [1pt] Solar surface granulation is caused by

- A) radioactivity.
- B) radiation.
- C) thermal flux.
- D) conduction.
- E) convection.

49. [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 times, but not at all places
- C) The Universe is the same at all times
- D) No part of the Universe looks like any other part
- E) The Universe is the same at all places

50. [1pt] The angle at which a star appears to move when observed from the ends of a baseline of 1 A.U. is the star's

- A) speckle.
- B) space velocity.
- C) parallax.
- D) radial velocity.
- E) proper motion.

51. [5pt] Match each statement with the appropriate object, and enter the associated letter.

- D a star which appears double by sight and is held to another gravitationally. A. optical double
- A two stars at different distances which happen to be along the same line of sight. B. eclipsing binary
- C a star whose double nature is indicated by variations in its doppler shift. C. spectroscopic binary
- B a star whose double nature is indicated by the varying intensity of its light curve. D. visual binary
- E a star whose double nature is indicated by its wobbling motion. E. astrometric binary

52. [1pt] One success of the inflationary theory of the Universe is that it can explain why the Universe appears to be

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

---

53. [1pt] The nearest galaxy to us in the Local Group that isn't a dwarf elliptical is \_\_\_\_\_ ?

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

---

54. [1pt] A graph of temperature versus magnitude for stars is sometimes known as a(n)

- A) periodic table.
- B) color-temperature diagram.
- C) astrometric chart.
- D) Hertzsprung-Russell diagram.
- E) star chart.

---

55. [1pt] The main value in the study of binary stars is the ability it gives us to determine stellar

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

---

56. [1pt] The imaginary boundary around a rotating black hole at which no particles can remain at rest is the

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

---

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

58. [1pt] After about 10 billion years on the main sequence a one-solar-mass star will have in its core no remaining

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

---

59. [1pt] Stars in the galactic halo are generally

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

---

60. [1pt] The notion that the Universe had an instant when it began is implied by its

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