

# ASTRO 150

## EXAM 3 - Sample

This examination is closed book. Please keep your answer sheet covered during the exam. Use a soft pencil when completing the computer answer sheet.

- \* Sit in the seat with the number that matches the number on the computer answer sheet
- \* Write your NAME, SS#, and SECTION NUMBER on the COLORED PAGES of the exam.
- \* In the NAME portion of the computer sheet, fill in your last name, leave one blank space, then continue with your first name.
- \* Enter your student ID number in the IDENTIFICATION NUMBER boxes of the computer sheet.
- \* Write your Section Number in spaces K and L of the SPECIAL CODE

Wednesday	9:00AM	Section 01	(Moe)
	10:00AM	Section 02	(Larry)
	11:00AM	Section 03	(Curly)
	12:10AM	Section 04	(Shemp)
	1:10PM	Section 05	(Moe)
	2:10PM	Section 06	(Moe)

- \* Fill in all circles corresponding to the letters/numbers of your name, ID number, and section.
- \* Turn in ALL PAGES OF THIS EXAM and the COMPUTER SHEET.

GOOD LUCK --- and RTFQ

### USEFUL FORMULAE

$$P \propto L \quad V = H_0 \times d \quad 1 \text{ Mpc} = 10^6 \text{ pc} \quad \Omega = \rho/\rho_{\text{crit}} \quad t \propto 1/H_0 \quad E = mc^2$$
$$N = R_s \times f_p \times n_p \times f_i \times f_c \times L$$

**Part I: Multiple Choice:** 40 questions, 2 points each. Select the *best* answer to each of the questions below. Place your answer on the computer answer sheet provided.

1. How do we know that quasars are extremely luminous?
  - a) they have very broad spectral lines
  - b) they have large red shifts, but are easily visible
  - c) they have large blue shifts, but are easily visible
  - d) they are extremely small
  - e) none of the above
2. Which of the objects below is about 150 Mpc in size?
  - a) the Virgo cluster of galaxies.
  - b) the "Great Wall" supercluster.
  - c) the local group of galaxies.
  - d) the Universe itself.
  - e) my back yard.
3. We see all distant galaxies moving away from us. This means that
  - a) we are in the center of an expanding universe.
  - b) we are at the edge of an expanding universe.
  - c) the Universe will expand forever.
  - d) observers from any point in space will see the same pattern with all distant galaxies moving away from them.
  - e) we smell bad.
4. Interstellar dust is opaque to \_\_\_\_\_ wavelength radiation, but is transparent to \_\_\_\_\_ wavelength radiation.
  - a) long ; red
  - b) short ; long
  - c) X-ray ; radio
  - d) long ; short
  - e) blue ; green
5. There are about \_\_\_\_\_ stars in the Milky Way.
  - a)  $3 \times 10^9$
  - b)  $2 \times 10^{11}$
  - c)  $9 \times 10^{57}$
  - d)  $2 \times 10^{33}$
  - e) 6000
6. We can determine the distance to a galaxy that contains Cepheid variables by using
  - a) the period-color relation.
  - b) the mass-luminosity relation.
  - c) the mass-radius relation.
  - d) the period-luminosity relation.
  - e) Wien's law.
7. The age of our universe is roughly \_\_\_\_\_ years, and the size of the observable universe is about \_\_\_\_\_ light years.
  - a) unknown; 12 billion
  - b) 12 billion; 12 billion
  - c) 12 billion; unknown
  - d) 12 million; unknown
  - e) 10 billion; 10 million

8. Which type of galaxy is dominated by Population II stars and contains little or no gas or dust?
- elliptical
  - spiral
  - barred spiral
  - irregular
  - lenticular
9. If a cluster of galaxies is receding from us at 80,000 km/s, its distance from us, using a Hubble constant of 80 km/s/Mpc, is
- 100 Mpc.
  - 400 Mpc.
  - 800 Mpc.
  - 1000 Mpc.
  - 8000 Mpc.
10. If the density of the universe is greater than the critical density the universe will
- continue to expand forever.
  - eventually stop expanding.
  - eventually stop expanding and begin contraction.
  - continue to contract forever.
  - eventually stop contracting and begin expanding.
11. Evidence shows that \_\_\_\_\_ % of the mass of the Milky Way is invisible (i.e. dark matter).
- 0; we can see all the matter in the Milky Way with either optical or radio telescopes
  - 1.0
  - 10
  - 50
  - 90
12. The Local Group is
- the nearest group of stars to the solar system.
  - the nearest open cluster.
  - the Andromeda Galaxy and its companions.
  - the cluster of galaxies in which the Milky Way galaxy is located.
  - The Bone People.
13. The Hubble constant has a value of
- 1-10 km/sec/kpc.
  - 50-100 km/sec/kpc.
  - 1-10 km/sec/Mpc.
  - 50-100 km/sec/Mpc.
  - greater than 500 km/sec/Mpc.
14. The  $3^{\circ}$  K radiation was caused by
- the formation of galaxies.
  - the big bang.
  - the formation of stars.
  - the formation of the planets.
  - the formation of supernovae.
15. What percentage of the mass of the universe was formed into helium during the Big Bang?
- 1%
  - 5%
  - 15%
  - 25%
  - 50%

16. In comparison with the Sun, stars located in the galactic halo are expected to have
- low metal abundances.
  - metal abundances similar to those in the Sun.
  - metal abundances higher than those in the Sun.
  - none of the above; we have no idea what the metal abundance is.
  - relatives in Chicago.
17. The active region of a quasar whose light output varies considerably in one month is
- one light-month in size.
  - one light-year in size.
  - one parsec in size.
  - the size of the Milky Way.
  - unknown in size.
18. At the time of the Big Bang the universe was
- cool with a low density.
  - cool with a high density.
  - hot with a high density.
  - hot with a low density.
  - square.
19. Our current best estimates of the density of matter in the universe indicates that the universe is
- open.
  - closed.
  - flat.
  - static.
  - triangular.
20. The rotation velocities of stars around the galactic center allows determination of the galaxy's
- distance.
  - mass.
  - radius.
  - luminosity.
  - all of the above.
21. Which one of the following does not enter into the Drake equation?
- rate of star formation
  - average length of a human life
  - average lifetime of a technological civilization
  - the number of Earth-like planets per star
  - the fraction of stars having planets
22. The solar system is located within
- the galactic halo.
  - the galactic disc.
  - the large intestine.
  - the galactic nucleus.
  - none of the above; the solar system is not located within a galaxy.
23. Radio observations at a wavelength of 21 cm are useful probes of the galaxy because
- they locate molecular hydrogen.
  - they find hot, ionized hydrogen clouds in the spiral arms.
  - they map neutral hydrogen in the spiral arms.
  - they keep radio astronomers busy and out of the way so theorists can solve the problems.
  - they can detect dark matter.

24. If you could scoop up a handful of the interstellar medium, what would be in your hands?
- almost nothing
  - dust
  - organic molecules
  - some hydrogen
  - all of the above
25. Astronomers in the 19th century thought that the Sun was near the center of the Milky Way since they counted the same number of stars in the disk of the Galaxy in every direction. The reason that they were not correct in their conclusion was that the Galaxy
- is an irregular galaxy with a chaotic shape.
  - contains dust that obscures the distant regions of the disk.
  - has the shape of a tube with the Sun at one end.
  - has a giant black hole at its center.
  - is surrounded by a massive dark halo.
26. How does the density wave model of spiral structure explain that the arms are brighter than the areas between the arms?
- There are more stars per volume in the arms than between them.
  - The arms are hotter than the area between them.
  - Brighter stars are in the spiral arms because they are formed there and are short lived.
  - Brighter stars are in the spiral arms because they move along with the arms
  - The area between the arms contains no material.
27. Which of the following forces may eventually halt the expansion of the Universe?
- nuclear forces
  - electromagnetic force
  - gas pressure
  - gravity
  - electron degeneracy pressure
28. A galaxy whose integrated color is reddish would be
- spiral.
  - elliptical.
  - irregular.
  - barred spiral.
  - indeterminate; color has nothing to do with galaxy type.
29. At the time of the Big Bang the universe was
- cool with a low density.
  - cool with a high density.
  - hot with a high density.
  - hot with a low density.
  - square.
30. Important differences between stars of Pop. I and Pop. II are that
- Pop. II stars are young and move slowly around the Galaxy.
  - Pop. II stars are metal poor and young.
  - Pop. II stars are metal poor stars in the galactic halo.
  - Pop. II stars are slowly moving stars in the galactic disc.
  - Pop. II stars are young, metal rich stars in the galactic nucleus.

31. Olbers' paradox results from asking the question
- what do the Mets keep losing with so many high-paid players?
  - what is a quasar?
  - what is the nature of the Universe?
  - why is the night sky dark?
  - what am I doing here?
32. The 3 K microwave background radiation has a spectrum similar to that of
- synchrotron radiation from a hot body.
  - thermal radiation from a cool body.
  - an emission nebula.
  - the Sun.
  - peat moss.
33. The largest confirmed (currently accepted) formations of matter in the universe are
- globular clusters.
  - galaxies.
  - clusters of galaxies.
  - clusters of clusters (superclusters).
  - clusters of clusters of clusters (super--superclusters).
34. The accretion disk surrounding a black hole is very hot due to compression caused by gravitational forces. This implies the object will emit strongly in which spectral region?
- X-ray
  - ultraviolet
  - visual
  - infrared
  - radio
35. The giant galaxy M87 is 3 times farther away than the spiral galaxy M51. The velocity of M87 will be \_\_\_\_\_ times \_\_\_\_\_ than the velocity of Galaxy B with respect to the Milky Way.
- 3 ; smaller
  - 3 ; bigger
  - 9 ; smaller
  - 9 ; bigger
  - none of the above
36. What type of galaxy is often found at the center of a galaxy cluster?
- a giant elliptical galaxy
  - a normal barred spiral galaxy
  - no particular type of galaxy is preferentially found at the center of a galaxy cluster
  - a dark galaxy
  - a giant spiral galaxy
37. What do radio galaxies, Seyfert galaxies, and quasars have in common?
- They are all different views of the same physical phenomenon.
  - All show evidence of massive black holes in their centers.
  - Their spectra show broad emission lines.
  - all of the above
  - none of the above

38. The acronym AGN stands for
- a) Amazing Grace Network
  - b) Active Galactic Nucleus
  - c) Astrophysically Gigantic Nebula
  - d) Altered Galactic Nebula
  - e) Abian's Gone Nuts
39. The diameter of the disk of our galaxy is closest to \_\_\_\_\_ parsec(s), or about \_\_\_\_\_ light years.
- a) 1 ; 3.26
  - b) 100 ; 326
  - c) 1,000 ; 3260
  - d) 18,000 ; 53,000
  - e) 30,000 ; 100,000
40. What type of galaxy is the Andromeda Galaxy?
- a) elliptical
  - b) spiral
  - c) irregular
  - d) dynamical
  - e) dwarf