

## Practice Exam 3

1. The dark energy was discovered using \_\_\_\_\_ as standard candles.

- (a) spectroscopic parallax
- (b) Cepheid Variables
- (c) Type Ia Supernovae
- (d) H II regions
- (e) Galaxies

2. The Cosmic Background Radiation:

I. Was discovered by Penzias and Wilson at Bell Labs

II. Was emitted at a redshift of  $z=1100$

III. Is nearly a perfect blackbody

- (a) I
- (b) I and II
- (c) I and III
- (d) I, II, and III

3. Why are hot stars better than cool stars at forming H II regions?

- (a) cool stars are surrounded by dust, rather than gas
- (b) hot stars are more massive
- (c) cool stars are too old
- (d) hot stars emit more ultraviolet radiation

4. The dust in our Galaxy makes stars seen through it appear

- (a) too faint and too red
- (b) too faint and too blue
- (c) too bright and too red
- (d) too bright and too blue

5. The red light coming from an H II region is produced by

- (a) the scattering of continuous light coming from a nearby star
- (b) interstellar reddening
- (c) spectral lines at 6563 Å emitted by excited H atoms
- (d) spectral lines of H redshifted to very high velocities

6. Rotation curves of galaxies show us that

- (a) Galaxies do not rotate like solid bodies
- (b) They flatten at large radii
- (c) There must be some unseen matter at large radii
- (d) They are evidence for Dark Matter
- (e) All of the above

7. Our solar system is located in the of \_\_\_\_ a \_\_\_\_ galaxy.
- (a) halo - elliptical
  - (b) nucleus - spiral
  - (c) disk - spiral
  - (d) disk - elliptical
8. A star cluster with a main sequence turn-off at spectral type A2 is a star cluster with its turn-off at G2
- (a) younger than
  - (b) older than
  - (c) the same age as
  - (d) more distant than
9. Which of these types of objects is NOT found in the halo of our galaxy?
- (a) globular clusters
  - (b) main sequence M stars
  - (c) H II regions
  - (d) dark matter
10. Our Galaxy is most like which of the following
- (a) the Andromeda galaxy
  - (b) M82
  - (c) the Large Magellanic cloud
  - (d) M87
11. Which kind of galaxy is least likely to contain H II regions?
- (a) spiral
  - (b) barred spiral
  - (c) elliptical
  - (d) irregular
12. An SBa galaxy would be characterized by
- (a) a very small nucleus
  - (b) a bar through the nucleus
  - (c) loosely wound (or open) spiral arms
  - (d) having only old stars and no gas or dust in it
13. Elliptical E7 galaxies appear to look like
- (a) basket balls
  - (b) cigars
  - (c) golden retrievers
  - (d) eggs

14. Which of the following is not a radio galaxy?
- (a) Cygnus A
  - (b) Large Magellanic Cloud
  - (c) Centaurus A
  - (d) M87 (Virgo A)
15. Which of these do we NOT expect to occur when two galaxies collide?
- (a) they will pass through one another
  - (b) their shapes will become distorted
  - (c) many stars will collide and explode
  - (d) there will be much star formation
16. Radio emission from quasars and radio galaxies is generally produced by
- (a) hot glowing gas
  - (b) electrons spiraling in a magnetic field
  - (c) supernovae
  - (d) electron-proton annihilation
17. Why must some quasars be small?
- (a) they are very bright
  - (b) they are radio sources
  - (c) they vary rapidly in brightness
  - (d) they have large redshifts
18. The redshift of a quasar's spectrum is caused by
- (a) the Doppler effect
  - (b) large gravities and a gravitational redshift
  - (c) synchrotron emission
  - (d) special relativity
19. Observations of a quasar called Sooner indicate a spectral line shift with a redshift, or  $Z$ , of 2. This means that Sooner
- (a) is moving at a velocity equal to the speed of light
  - (b) is moving at a velocity typical of galaxies near the Milky Way, like the Andromeda galaxy
  - (c) is moving at a velocity of approximately 200% the speed of light
  - (d) is moving at a velocity that is close to, but less than, the speed of light
  - (e) emitted the light when the Universe was  $\frac{1}{2}$  of its current size
20. The main difficulty in understanding quasars is that
- (a) their spectra are blueshifted whereas we would expect them to be redshifted
  - (b) they emit large quantities of energy from small volumes of space
  - (c) they appear to be receding at velocities faster than the speed of light
  - (d) none have yet been detected with radio telescopes

21. Seyfert galaxies

- (a) are a special type of irregular galaxy
- (b) are traveling toward us at high speed
- (c) have small bright nuclei
- (d) result from collisions of galaxies

22. If a spaceship approaches you at a constant velocity of 90% of the speed of light, you would see its clocks running (compared with yours)

- (a) backwards
- (b) fast
- (c) the same
- (d) slow

23. The observational evidence that the Universe is flat (or very nearly so) is based on:

- (a) measuring the distance to Type Ia supernovae
- (b) measuring the cosmic background radiation
- (c) The cosmological principle
- (d) the general theory of relativity

24. According to special relativity, two observers in uniform relative motion will NOT disagree on

- (a) the mass of an object
- (b) the distance (or length) between two objects
- (c) the time interval between two events
- (d) the speed of light

25. The Local Group is

- (a) the part of the universe which can be observed by the largest telescopes on earth
- (b) a cluster of stars in the local vicinity, to which the sun belongs
- (c) one of the band's that I play at the beginning of class
- (d) a collection of about 2 dozen galaxies, to which our galaxy belongs

26. According to the theory of special relativity, it is not possible to

- (a) travel faster than the speed of light
- (b) have curved space
- (c) have black holes
- (d) see the center of our galaxy

27. The primordial background radiation

- (a) is coming mainly from distant galaxies and quasars
- (b) comes mainly from the direction of the Milky Way
- (c) is equally strong in all directions in the sky
- (d) is strongest at visible wavelengths

28. According to the big bang model, when did galaxies first form?
- (a) during the first seconds after the big bang
  - (b) when the universe reached a temperature of 3 K
  - (c) after hundreds of thousands of years
  - (d) during the heavy particle era
29. The universe is (expanding, contracting) and the galaxies farthest from us appear to be traveling (fastest, slowest)
- (a) expanding, fastest
  - (b) contracting, fastest
  - (c) expanding, slowest
  - (d) contracting, slowest
30. The age of the universe is estimated to be
- (a) 4.6 billion years
  - (b) 10 million years
  - (c) 14 billion years
  - (d) infinite
31. If the density of matter in the universe exactly equals the critical density (as current observations and theory seem to suggest), then the universe is
- (a) open
  - (b) closed
  - (c) flat
  - (d) static and unchanging
32. Olbers' paradox
- (a) has something to do with quasars
  - (b) has something to do with time variability of the light from Seyfert galaxies
  - (c) has something to do with the night sky being dark
  - (d) well, there is this story about two dox . . .
33. Which would you NOT expect to be produced by the big bang?
- (a) radiation
  - (b) helium
  - (c) carbon
  - (d) hydrogen
34. According to the big bang model, when did helium first form?
- (a) during the first micro second after the big bang
  - (b) when the universe reached a temperature of 3 K
  - (c) after (approximately) hundreds of thousands of years
  - (d) during the radiation era

35. Our Galaxy has a lower total luminosity than
- (a) a globular cluster
  - (b) most irregular galaxies
  - (c) either of the (Large or Small) Magellanic clouds
  - (d) a quasar