

## ASTRONOMY 1504

### Third Exam – November 6, 2009

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1. One of the basic postulates, on which special relativity is based, is that
  - (a) space is curved
  - (b) time is absolute
  - (c) the speed of light in a vacuum is an absolute constant of nature
  - (d) there is no such thing as a free lunch
2. Suppose you had a twin and you traveled into space (leaving your twin behind on earth) moving at 90% the speed of light and then returned to earth. When you returned, you would be
  - (a) older than your twin
  - (b) the same age as your twin
  - (c) younger than your twin
  - (d) unchanged in age
3. Suppose you were traveling on a spaceship moving *toward* earth at 90% the speed of light. If you were able to look at the clocks on the earth, relative to your clock on the spaceship, clocks on the earth would appear to move
  - (a) faster
  - (b) slower
  - (c) the same
  - (d) not at all
4. Mu mesons, created in the upper atmosphere of the earth by cosmic rays, can make it down to the surface of the earth even though they do not live very long because
  - (a) they are electrically charged and the earth's magnetic field carries them down
  - (b) they move at the speed of light
  - (c) they experience time dilation
  - (d) they are attracted by the gravity of the earth
5. If an electron is moving in a synchrotron at 99% of the speed of light you will measure its mass to be
  - (a) infinite

- (b) greater than that of an electron at rest
  - (c) the same as that of an electron at rest
  - (d) less than that of an electron at rest
6. We observe a star surrounded by a reflection nebula. Which is a true statement?
- (a) the nebula appears redder than the star
  - (b) the nebula appears bluer than the star
  - (c) the nebula and the star appear to have the same color
  - (d) the star's light looks bluer as seen through the nebula
7. Emission nebulae glow as a result of the process called
- (a) synchrotron radiation
  - (b) scattering
  - (c) fluorescence
  - (d) interstellar reddening
8. Most of the globular clusters are located in the Galactic
- (a) spiral arms
  - (b) nucleus
  - (c) halo
  - (d) disk
9. Consider two star clusters, Boomer and Sooner. If Boomer and Sooner have a "main sequence turnoff" at spectral type B and spectral type A respectively, which cluster is older?
- (a) Boomer
  - (b) Sooner
  - (c) they are the same age
  - (d) impossible to tell
10. Our Galaxy rotates differentially, analogously to stirring coffee in a cup. That means that matter (stars and gas) that is located farther from the galactic center than the sun
- (a) rotates at a slower velocity than the sun
  - (b) rotates at a faster velocity than the sun
  - (c) rotates at the same velocity as the sun
  - (d) rotates like a compact disk
11. Where is the sun located in our Galaxy?
- (a) in the disk

- (b) in the halo
  - (c) in the nucleus
  - (d) in a globular cluster
12. A barred spiral with a small central bulge and loosely wound, patchy arms would be classified as
- (a) SBc
  - (b) Sb
  - (c) Sc
  - (d) SBa
13. A galaxy which has only old, low-mass stars, with very little or no interstellar matter, is likely to be
- (a) a spiral
  - (b) an elliptical
  - (c) an irregular
  - (d) a Seyfert
14. Elliptical E0 galaxies appear to look like
- (a) basket balls
  - (b) cigars
  - (c) golden retrievers
  - (d) eggs
15. The large Magellanic Cloud is
- (a) an atmosphere disturbance over southern Chile
  - (b) an irregular galaxy
  - (c) an interstellar dust cloud
  - (d) a cluster of galaxies
16. When galaxies collide
- (a) generally only a very few stars will hit each other
  - (b) one or both of the galaxies will explode
  - (c) any gas and dust in them will cool off
  - (d) all of the above
17. The radio lobes in Cygnus A
- (a) are falling into the central galaxy (*i.e.* the optical galaxy that we see)
  - (b) have been ejected by the central galaxy in jets

- (c) are regions where stars are forming
  - (d) are the result of collisions between galaxies
18. The radio emission we detect from twin-lobed radio galaxies is produced by
- (a) fluorescence
  - (b) the primordial background radiation
  - (c) nuclear fusion
  - (d) synchrotron radiation
19. The radio galaxy which is an E0 galaxy and has a VISIBLE jet and a massive black hole at the center is known as
- (a) the Andromeda galaxy
  - (b) Cygnus A
  - (c) the Large Magellanic Cloud
  - (d) M87 (or Virgo A)
20. Our Galaxy
- (a) is isolated in space in a giant intergalactic void
  - (b) belongs to a small ( $\sim 21$ ) group of galaxies
  - (c) belongs to a cluster of thousands of galaxies
  - (d) is currently colliding with another galaxy
21. When we determine the mass of clusters of galaxies, the gravitational mass is much larger than the mass that we observe by adding up all of the individual galaxies. How do astronomers explain this?
- (a) we must have miscounted the number of galaxies and there are really lots more
  - (b) there must be lots of “dark matter” in the clusters
  - (c) the cosmological principle tells us that physics (including gravity) in these distant clusters does not work the same way as on earth
  - (d) as a result of Hubble’s law, the clusters are much farther away than we think they are, resulting in larger masses
22. Suppose that quasar Sooner is observed to vary by a factor of about 5 over a period of one month. What is the maximum size of the active part (the part we see) of Sooner?
- (a) the distance between the sun and the next nearest star
  - (b) the diameter of the sun
  - (c) the distance light travels in one month
  - (d) the distance between the sun and the center of the Galaxy

23. The great distance of quasars, together with the fact that we see them at all, tells us that quasars are
- (a) highly massive
  - (b) very large in diameter
  - (c) high temperature objects
  - (d) highly luminous (or energetic)
24. Which of the following is true about the spectra of galaxies **and** quasars
- (a) both show only absorption spectra
  - (b) galaxies have mostly broad emission lines; quasars have no spectral lines
  - (c) quasars have blue-shifted spectral lines; galaxies only red-shifted spectral lines
  - (d) both have red-shifted lines, but quasars have very large red shifts and show emission lines
25. Which of the following is the largest concentration of matter in the Universe?
- (a) the Local Group
  - (b) globular clusters in our Galaxy
  - (c) super clusters
  - (d) the Virgo cluster of galaxies
26. Peculiar galaxies are most likely produced as a result of
- (a) the evolution of an elliptical galaxy into a spiral
  - (b) being ejected from another galaxy, much like a quasar
  - (c) collisions between galaxies
  - (d) Hubble's law
27. In a static, infinite and eternal universe, we would expect the night sky to be very bright (in the optical part of the spectrum) because
- (a) we would eventually see a star in every direction
  - (b) of the microwave radiation from the big bang
  - (c) very distant galaxies are approaching us
  - (d) such a universe would have more main sequence O stars
28. In the big bang model, arrange the following periods in the correct order from earliest (in time) to latest
- (a) light particle era, heavy particle era, matter era, radiation era
  - (b) heavy particle era, light particle era, radiation era, matter era
  - (c) radiation era, matter era, heavy particle era, light particle era

- (d) light particle era, heavy particle era, radiation era, matter era
29. Most of the helium that we observe in the universe was produced in
- (a) the center of stars
  - (b) the big bang
  - (c) H II regions
  - (d) the helium flash
30. The universe currently has a temperature of approximately
- (a) 3 K
  - (b) 300 K
  - (c) 3,000 K
  - (d) 3,000,000 K
31. The primordial background radiation
- (a) is strong evidence in favor of the big-bang theory
  - (b) could be equally well explained by a static constant universe
  - (c) was emitted by distant galaxies and quasars
  - (d) is observable on the surface of the earth in the ultraviolet
32. The region into which the big bang exploded was previously filled with
- (a) empty space
  - (b) blackbody radiation
  - (c) dark matter
  - (d) there was no such region
33. According to the big bang model, in the very early stages (*i.e.* minutes) of the universe it was
- (a) collapsing to a point
  - (b) producing lots of population I stars
  - (c) hot and dense
  - (d) cold and dense
34. Hubble's constant relates the \_\_\_\_\_ and \_\_\_\_\_ of galaxies
- (a) redshifts and velocities
  - (b) distances and rotations
  - (c) rotations and masses
  - (d) distances and velocities
35. The center of the universe is located

- (a) in the Local Group
- (b) in the center of the Milky Way
- (c) in the center of the supercluster of galaxies containing the Local Group
- (d) none of the above; there is no center