PHYSICS 113
Practice Test #3

1. To predict whether a star will ultimately become a black hole, what is the key property of the star we should look at?
   a. mass b. surface temperature c. color d. distance e. diameter

2. The region around a black hole where everything is trapped, and nothing can get out to the rest of the universe, is called
   a. the singularity b. the neutron star radius c. the gravitational redshift zone d. the event horizon e. none of the above

3. Once a black hole forms, the size of its event horizon is determined only by
   a. the size of the star that collapsed into the black hole b. the mass inside the event horizon c. the time since the black hole formed
   d. the composition of the material that formed the black hole e. every black hole has an event horizon of the same size

4. Our Milky Way Galaxy is what type of galaxy?
   a. spiral b. elliptical c. dwarf elliptical d. irregular e. none of the above

5. Where would you look for the youngest stars in the Milky Way Galaxy?
   a. in the halo b. where there is dark matter c. in the disk d. in the nuclear bulge e. my chances of finding a very young star are the same everywhere

6. If I want to find a sizeable collection of Population II stars in the Milky Way Galaxy, where would be a good place to look?
   a. near the Sun b. in a globular cluster high above the Galaxy's disk c. in the Orion spiral arm d. on the outer surface of giant molecular clouds
   e. in an open cluster, especially one with a lot of dust in and around it

7. The most stable element in the universe (the one that doesn't "like" to undergo either nuclear fusion or fission) is:
   a. hydrogen b. carbon c. uranium d. technetium e. iron

8. Many irregular galaxies show strange shapes--elongated or chaotic. What explanation do astronomers now believe is responsible for these shapes?
   a. irregular galaxies are born with such fast rotation, they spin apart
   b. irregular galaxies have experienced a huge chain of supernova explosions which have destroyed whatever structure they originally had
   c. irregular galaxies do not have any gas or dust in them, so the stars are free to move in strange orbits
   d. irregular galaxies have experienced or are experiencing collisions or interactions with neighbor galaxies
   e. none of the above

9. What method would astronomers use to find the distance to a galaxy so far away that individual stars are impossible to make out (resolve)?
   a. parallax b. Cepheid variables c. using the x-ray emission from the entire galaxy d. finding the redshift and using Hubble's Law
   e. the turnoff point of the main sequence on an H-R diagram

10. Which of the following objects is NOT considered useful to astronomers as good "standard candles" for determining distances?
    a. type I supernovae b. planetary nebulae c. K-type stars d. the brightest supergiant stars in a galaxy e. globular clusters

11. Edwin Hubble was able to show that (with the exception of our nearest neighbors) the farther a galaxy is from us, the
    a. brighter it looks b. bluer its color c. the later in its life we are seeing it d. the larger its halo is e. the faster it is moving away from us

12. According to Hubble's Law, if galaxy B is three times farther away from us as Galaxy A, then Galaxy B will
    a. move toward us three times faster than A b. move away from us nine times faster than A c. move away from us three times faster than A
    d. move toward us nine times faster than A e. move away from us at about the same speed as A

13. If quasars often resemble little blue stars, what was it about them that so surprised astronomers when they were discovered?
    a. their surface temperatures were among the lowest measured b. they show absolutely no lines in the spectrum c. they vary their brightness with a period (time-scale) of seconds d. they were all located in globular clusters e. their spectral lines were at first hard to recognize and then turned out to have large redshifts

14. What method would astronomers use to find the distance to a remote quasar?
    a. parallax b. Cepheid variables c. using a Type I supernovae d. finding the redshift and using Hubble's Law e. the turnoff point of the main sequence

15. If quasars are at the distances most astronomers believe they are, then (for the most luminous ones) their luminosities must be:
    a. like the Sun b. like the combined luminosity of a cluster of a hundred stars c. much fainter than the Sun d. like a supergiant
    e. like the combined luminosity of a hundred trillion (10^{14}) Suns

16. Today, astronomers find compelling evidence that the energy source of the quasars and active galaxies is
    a. antimatter and matter colliding at the center of a galaxy b. chain reactions of supernova explosions c. matter falling into a supermassive black hole
    d. the left-over (and stored) energy of the big bang explosion e. none of the above

17. In the gravitational lenses astronomers have discovered so far, the mass *causing* the lensing effect is usually
    a. a neutron star b. a galaxy or galaxy cluster c. a very distant quasar d. the Sun e. a form of matter that has not yet been identified

18. According to the Cosmological Principle, the universe
    a. has no beginning and no end b. cannot be understood by the use of scientific observations alone c. is isotropic and homogeneous
    d. consists only of galaxies that are exactly like the Milky Way e. has all the galaxies arranged in groups about the size of our Local Group

19. The rich galaxy cluster that is closest to our Local Group of galaxies is the
a. Coma Cluster b. Hercules Cluster c. Virgo Cluster d. Ursa Major Cluster e. Trifid Cluster

20. The great voids that astronomers are finding are:
a. regions where a number of black holes have cleared out space in the center of a galaxy b. empty regions between the spiral arms of the Galaxy
c. huge HII regions, where the powerful radiation from a hot star has cleared out the local interstellar material
d. very large regions of intergalactic space, where relatively few galaxies or galaxy clusters can be found e. none of the above

21. An astronomer discovers a massive galaxy which has four nuclei--dense central regions. What is a likely explanation for a galaxy having more than one nucleus?
a. the nuclei of galaxies often split into two or more parts because of internal activity b. the galaxy must have been a quasar earlier in its life
c. the galaxy must have swallowed several smaller galaxies that were its neighbors d. the galaxy must have had an unusual number of supernova explosions e. none of the above

22. What kind of telescope did Jocelyn Bell use to discover pulsars in 1968?
a. visible light b. radio c. ultraviolet d. x-ray e. neutrino

23. The expansion of the universe, according to astronomers, is:
a. a theory for which there is no observational evidence b. a piece of established observational evidence which any theory of cosmology must use
c. a prediction of <u>one</u> theory of cosmology for which the evidence is very controversial d. the opposite of what Hubble's Law describes
e. none of the above

24. What causes the expanding universe to slow down?
a. supernova explosions can act as a sort of brake on the motion of the galaxies b. strong gravity makes the pace at which time flows around galaxies speed up c. the gravity of the galaxies pulls them together d. the cooling of the background radiation makes space less elastic e. none of the above

25. Which of the following is pretty good evidence that the universe began with a Big Bang?
a. the fact that galaxies collide b. the fact that stars explode c. the fact that all the galaxies are moving toward us d. the existence of a double star system like Cygnus X-1 e. the cosmic (3-degree) background radiation

26. In describing the universe using his equations of general relativity, Einstein assumed that it was <u>isotropic</u> (the same in all directions.) What recent observations have confirmed that the universe is isotropic on the large scale?
a. the discovery of pulsars b. the discovery of cannibal galaxies c. measurements of the 3-degree cosmic background radiation
d. measurements of neutrinos from Supernova 1987A e. none of the above

27. In an open universe model, the entire universe has
a. a beginning b. a center c. an edge d. an end e. none of the above

28. In the closed model of the universe, the universe ends with:
a. a Big Crunch b. a gradual cooling, thinning, and darkening of the contents of the universe c. a sudden cold freeze that will halt all motion
d. the galaxies expanding faster and faster e. the closed universe model does not predict an end for the universe

29. Which of the following elements was NOT formed during the Big Bang:
a. hydrogen b. carbon c. lithium d. helium e. none of the above

30. Elements heavier than iron can only be created during:
a. the big bang b. the main sequence c. a supernova explosion
d. the red giant stage in a star's life e. astronomers don't have any idea of where these elements came from; it's an unsolved mystery

SHORT ANSWER:

1. What observations help show us that the universe is evolving in time?

2. Describe the three possible fates of the Universe according to the standard big bang model.

3. Explain how an intermediate mass star evolves in terms of its track in the HR diagram.

4. If the universe was filled with old (cold) white dwarfs, how would this help resolve the dark matter problem?

5. How do astronomers determine distances to objects in: (i) solar system; (ii) the Galaxy; (iii) nearby galaxies (e.g., M31); (iv) galaxies and clusters (up to 100 Mpc); (v) quasars?

6. What is a standard candle? List five standard candles and indicate which are the best at estimating the largest distances.