ASTR1102-002

(Extended set of…) Practice Questions for Exam #3

1. Stars on the main sequence cannot have a mass less than 0.08 solar masses. Why can't stars have less mass than this?
2. Low-mass stars on the main sequence (called 'red dwarfs') have masses ranging from _____ solar masses to _____ solar masses. (Fill in the blanks.)
3. Moderately low-mass stars on the main sequence have masses ranging from _____ solar masses to _____ solar masses. (Fill in the blanks.)
4. High-mass stars on the main sequence have masses ranging from _____ solar masses to _____ solar masses. (Fill in the blanks.)
5. The sun is considered to be a _____ star. (Fill in the blank.)
    a. High-mass
    b. Low-mass
    c. Moderately low-mass
6. Why doesn't a low-mass star ever evolve off of the main sequence?
7. Approximately how long will it take for a 0.5 solar-mass star to exhaust all of its hydrogen fuel and die?
8. Approximately how long does it take for a 1.0 solar-mass star to exhaust all of its hydrogen fuel and start evolving off of the main sequence? [Answer the same question, but for stars having 3.0, 15.0, and 25.0 solar masses.]
9. The interior regions of _____ stars are fully convective. (Fill in the blank.)
    a. High-mass
    b. Low-mass
    c. Moderately low-mass
10. When a moderately low-mass star is in the red-giant phase of its evolution, it is fusing _____ in its central core and it is fusing _____ in a shell that surrounds the central core. (Fill in the blanks.)
    a. Hydrogen into helium
    b. Helium into carbon & oxygen
    c. Carbon into magnesium
    d. Hydrogen & Oxygen into water
11. What does the acronym "AGB" stand for?
12. When the Sun evolves to become an AGB star, it will swell up so that its surface engulfs the Earth. (True or False?)
13. When the Sun evolves to become an AGB star, its central core will be undergoing Carbon fusion. (True or False?)
14. When a high-mass star is in the red-giant phase of its evolution, it is fusing _____ in its central core and it is fusing _____ in a shell that surrounds the central core. (Fill in the blanks.)
    a. Hydrogen into helium
    b. Helium into carbon & oxygen
    c. Carbon into magnesium
    d. Hydrogen & Oxygen into water

15. When a high-mass star is in the AGB phase of its evolution, it is no longer fusing hydrogen into helium. (True or False?)
16. When a high-mass star is in the supergiant phase of its evolution, its central core can be described as having an "onion-skin" structure. What does this mean?
17. A supergiant star has a radius that is _____ the radius of an AGB star? (Fill in the blank.)
    a. Smaller than
    b. Larger than
    c. Approximately the same as
18. A "planetary nebula"is a gaseous nebula that forms during the late stage of evolution of a _____ star. (Fill in the blank.)
    a. High-mass
    b. Low-mass
    c. Moderately low-mass
19. A "supernova remnant"is a gaseous nebula that forms during the late stage of evolution of a _____ star. (Fill in the blank.)
    a. High-mass
    b. Low-mass
    c. Moderately low-mass
20. After the hot, central star of a planetary nebula cools off, it will become a _____. (Fill in the blank.)
    a. Planet
    b. Red dwarf
    c. Brown dwarf
    d. White dwarf
    e. Neutron star
    f. Black hole
21. The compact star that has been found at the center of the crab nebula is a _____. (Fill in the blank.)
    a. Planet
    b. Red dwarf
    c. Brown dwarf
    d. White dwarf
    e. Neutron star
    f. Black hole
22. What is the typical mass of a white dwarf star?
23. What is the maximum mass a white dwarf star can have?
24. What is the typical mass of a neutron star?
25. What is the maximum mass a neutron star can have?
26. All pulsars are neutron stars. (True or False?)
27. All neutron stars are pulsars. (True or False?)
28. How are planetary nebulae and supernova remnants relevant to the existence of life on Earth? (Hint: Discuss the return of nuclear-processed elements to the interstellar medium and the formation of stars.)
29. What did the Chinese astronomer, Yang Wei-T'e, observe on the morning of July 4, 1054?

30. How is the astronomical object discovered by Yang Wei-T'e related to the Crab nebula?
31. Who discovered the first pulsar? What was the pulsation period of this first-discovered pulsar?
32. When the Sun dies, it will become a _____. (Fill in the blank.)
    a. Pulsar
    b. Red dwarf
    c. Brown dwarf
    d. White dwarf
    e. Neutron star
    f. Black hole
33. When a high-mass star dies, it will become a _____. (Fill in the blank.)
    a. Pulsar
    b. Red dwarf
    c. Brown dwarf
    d. White dwarf
    e. Neutron star
    f. Black hole
34. The crab pulsar has a pulsation period of _____. (Fill in the blank.)
35. How often do supernova explosions occur in a typical galaxy?
36. Over the past 1000 years, how many supernova explosions have occurred in our own Milky Way Galaxy?
37. What is the difference between a "Type II" supernova and a "Type Ia" supernova?
38. The Crab nebula is about 2000 pc away from us. How long does it take light to travel from the Crab nebula to us? (Remember: 1 pc = 3.26 light years.) Based on this information, in what year did the Crab supernova explosion actually occur?
39. Only 4 gaseous supernova remnants have been identified in our Galaxy. (True or False?)
40. Only 4 pulsars have been identified in our Galaxy. (True or False?)
41. A pulsar is an eclipsing binary star. (True or False?)
42. A pulsar is a white dwarf star that is undergoing very regular radial pulsations. (True or False?)
43. A pulsar is a rapidly spinning white dwarf star. (True or False?)
44. A pulsar is a rapidly spinning neutron star that contains a strong magnetic field. (True or False?)
45. How is a pulsar similar to a light-house beacon?
46. In what galaxy did the supernova named 'SN 1987A' occur?
    a. The Milky Way Galaxy
    b. The Andromeda Galaxy
    c. The Crab Galaxy
    d. The Large Magellanic Cloud
    e. The Small Magellanic Cloud
    f. None of the above.
47. SN 1987A was bright enough to be seen during the daytime for several weeks. (True or False?)

48. The LMC is about 51,500 pc away from us. How long does it take light to travel from the LMC to us? (Remember: 1 pc = 3.26 light years.) Based on this information, in what year did the SN 1987A explosion actually occur?
49. What did the two "particle physics" detectors (the Kamiokande and IMB detectors) discover on February 23, 1987? How did these discoveries help us understand the death of massive stars?
50. In an interacting binary star system, mass can be transferred from one star to the other. This type of interaction can give rise to which of the following astronomical phenomena? (Circle all that apply.)
    a. Type II supernova
    b. Type Ia supernova
    c. Millisecond pulsar
    d. Nova
    e. Planetary nebula
    f. Merger of two stars
    g. Sunspots
51. In a cataclysmic variable, mass is being transferred from a relatively normal star onto _____. (Fill in the blank.)
    a. A black hole
    b. A neutron star
    c. Another normal star
    d. A white dwarf
    e. A brown dwarf
52. In the binary star system that has been nicknamed the "black widow pulsar,"mass is being transferred from a relatively normal, low-mass star onto _____. (Fill in the blank.)
    a. A black hole
    b. A neutron star
    c. Another normal star
    d. A white dwarf
    e. A brown dwarf
53. How do astronomers detect black holes?
54. Following the example shown in Box 22-2 of the textbook, calculate the Schwarzschild radius of a 1 solar-mass black hole.
55. What is the escape velocity from the "surface" (i.e., event horizon) of a black hole?
56. Name three measurements that have been made by astronomers that confirm the predictions of Einstein's general theory of relativity.
57. What is LIGO? Where is it located? What has LIGO been designed to measure?
58. Suppose an astronaut who is living in the International Space Station has a watch that is identical to the watch you are wearing while you are standing still on the surface of the Earth. In the time it takes 3600 seconds (that is, one hour) to tick by on your watch, how much time has advanced on the astronaut's watch? Answer this question both from your perspective as well as from the perspective of the astronaut, and be sure to consider the effects of both special and general relativity.
    a. Fewer than 3600 seconds have ticked by on the astronaut's watch.
    b. More than 3600 seconds have ticked by on the astronaut's watch.

59. Briefly explain the relativistic concept of “length contraction.”
60. Briefly explain the relativistic concept of “time dilation.”