

Astronomy 1020 Exam 4 Review Questions

1. What is meant by the asymptotic giant branch? Describe the interior structure of a star when it is on the AGB.
2. What is meant by *dredge up* and by *thermal pulse*?
3. How are carbon stars made?
4. What is a planetary nebula? Why does such a nebula shine?
5. What are the differences between a detached, semidetached, and contact binary? What is a Roche lobe and Lagrangian points?
6. Define the following: carbon detonation, core bounce, and supernova.
7. What are the differences between Mira variables, Cepheid variables, and RR Lyrae stars? How are they similar? Define instability strip, period-luminosity relation, opacity, and kappa effect.
8. What is quantum mechanics? What are the 4 quantum numbers and what do they describe? Describe the Pauli Exclusion Principle in terms of quantum mechanics.
9. What are 3 end states of stars? What is the Chandrasehkar limit and how is it related to degenerate electron pressure? What is the maximum mass of a white dwarf and why is this the maximum mass? What are the 2 closest white dwarf stars to the solar system? From what you know of stellar evolution, describe how the brightest star in the sky may have appeared to our ancient ancestors.
10. Describe how neutron stars are born. What are pulsars? Describe the *lighthouse* model of a pulsar. When pulsars were first discovered, what were they thought to be? What is the maximum mass of a neutron star? Describe why this is the maximum mass and how this relates to the Chandrasehkar limit of a white dwarf star.
11. Describe the differences, both observational and physical, between Type I & Type II supernovae, and novae. Name one of the supernovae remnants seen in the sky.
12. How are a Type Ia, Type Ib, and Type Ic supernova different? What is a Type I $\frac{1}{2}$ supernova?
13. What is meant by the **Ether**? Why was it needed? Explain how the electromagnetic theory and the special theory of relativity show that the Ether is not needed.
14. Why was the Michelson-Morley experiment important? What are the 2 postulates of special relativity? What is meant by time dilation, length contraction, and mass increase without bound? Experimentally, how was special relativity confirmed?

15. How is the general theory of relativity different from the special theory of relativity? What is the principle of equivalence? What does matter do to space-time? Experimentally, how was general relativity confirmed (list at least two experiments)?
16. How is a black hole defined? What is a singularity, an Einstein-Rosen bridge, and a wormhole? How are they related to each other? How are the Schwarzschild radius and the event horizon related? What is hyperspace?
17. What happens to tidal forces and time as you approach a black hole?
18. Calculate the Schwarzschild radius for a 10^{-10} kg black hole (*e.g.*, a mini-black hole), a $3 M_{\odot}$ black hole (minimum mass stellar black hole), a $20 M_{\odot}$ stellar black hole, a million solar-mass black hole, and a billion (10^9) solar-mass black hole.
19. What would the mass of a black hole be if its Schwarzschild radius was the same radius as the Sun?
20. What 3 observational characteristics do the best black hole candidates possess? What are the 4 best black hole candidates that have been observed? Of these 4, which is the best stellar black hole candidate?
21. What is a hyperfine structure spectral line? At what wavelength is hydrogen's hyperfine structure line? How is this line used to map the structure of the Milky Way Galaxy?
22. Draw an edge on view of the Milky Way and label the halo, disk, bulge, globular clusters, and position of the Sun. Give the dimensions (in light years or parsecs) of the disk of the Milky Way. How far is the Sun from the galactic center? What are the main characteristics of the halo and the disk of the Galaxy? In which spiral arm does the Sun currently reside?
23. What is the difference between Population I, Population II, and Population III stars?
24. Compare and contrast galactic and globular star clusters. By what other name are galactic clusters called?
25. What is meant by the rotation curve of the Galaxy? What does the non-Keplerian shape of the curve in the outer regions of the Galaxy suggest about the halo? When compared to the light distribution, what else can you say about the halo? How long does it take the Sun to complete one orbit about the center of the Galaxy? As such, what is the length of its galactic year? How old is the Sun in galactic years?
26. What is meant by dark matter?
27. Describe the complete history of the Milky Way Galaxy. What were the first types of stars to form in the Galaxy? How is the formation of the Galaxy and the formation of the solar system similar?

28. What are spiral tracers and name all of them? Describe the difference between the density wave theory and the differential rotation theory. Why do one of these fail in explaining the spiral structure of the Milky Way?
29. What is meant by the local bubble and how is it related to Geminga?
30. Describe the center of the Milky Way Galaxy. What marks the center of the Galaxy in the sky?
31. What is a black dwarf (do not confuse this with black hole) and how is it related to a white dwarf? What is the dominant energy transport mechanism inside a white dwarf?
32. What is an accretion disk and a cataclysmic variable.
33. Who was the first person to accurately figure out the size of the Milky Way Galaxy? How did he/she determine this? Why did astronomers prior to the 20th century assume that we were at the center of the Galaxy?
34. What is the mass of the Milky Way (in solar masses) and how many stars exist in our Galaxy?
35. What is meant by **disk population** of stars? Why do Population II stars have high velocities with respect to the Sun?