Review Questions Answer KEY Stellar Evolution

1. By what process does the sun generate its energy? Describe the reaction.

   Nuclear fusion H→ He → energy

2. What is hydrostatic equilibrium?

   Pressure increases gravity decreases are in the balance

3. Explain how stars form from clouds of gas and dust. What is this process known as?

   Interstellar cloud → Protostar (gravitational contraction) → Accretion

4. What is the difference between a main sequence star and a brown dwarf?

   Main sequence still undergoing nuclear fusion ; brown dwarf failed star

5. What is the main relationship between mass and luminosity on the HR diagram?

   The larger the mass, the greater the luminosity

6. What do main sequence stars all have in common?

   They are still undergoing nuclear fusion

7. How does our Sun's temperature and size compare to that of other stars?

   It is only average

8. Why does the lifetime of a star depend on its mass?

   Larger stars die sooner, smaller stars have a longer lifetime

9. Compare a blue giant to a red dwarf. What do they have in common? What is different between them?

   Both blue giants and red dwarfs are at the far ends of the main sequence

   Blue Giants are large, hot and very luminous

   Red Dwarfs are small, cool, and dim

10. After the main sequence stage, what will our Sun evolve into next? What are the characteristics of this stage?

    Red Giants big, bright and cool

11. In Red Giants, how is the nuclear fusion process different from main sequence stars?

    Helium is now fusing into heavier elements

12. Consider a star like our sun that is a main sequence star and then consider the same star as a red giant. Compare the core temperature of the star as a main sequence star to the core temperature as a Red Giant. Compare the surface temperature of the star as a main sequence star to the core temperature as a Red Giant.

    Core temperature of main sequence star is hotter than Red Giant

13. Why will a red dwarf not become a Red Giant?

    It is too small

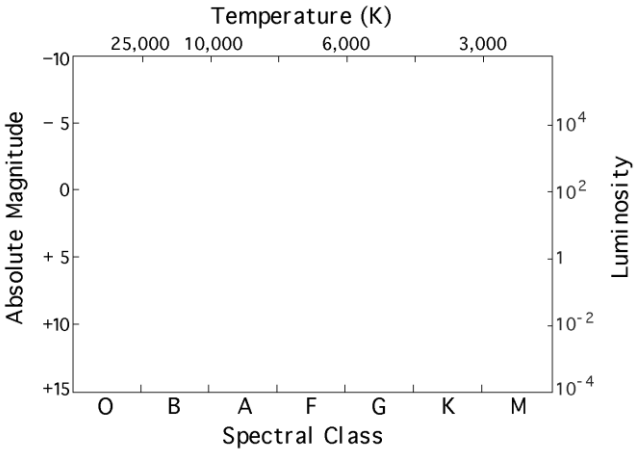
14. Which will evolve faster, a Blue Giant or a red dwarf? Explain why.

    Blue Giant the larger mass

15. What is the classification of our Sun right now?

    Main sequence class F average

16. Sketch the Hertzsprung-Russell Diagram (the H-R diagram) and label all the main sections.



17. Describe the general characteristics of red dwarfs.

    Small, cool, dim

18. Describe the general characteristics of white dwarfs.

    Small, hot, bright

19. Describe the general characteristics of red giants.

    Large, cool, dim

20. Describe the general characteristics of blue giants.

    Large hot, bright

21. What is the mass-luminosity relationship that we find for main sequence stars?

    The larger the mass, the brighter the star

22. Sketch out the evolutionary track of our Sun and label where it will go on the HR diagram (there are three distinct locations you should mark).

23. When we say that a star moves from one spot on the HR diagram to another, does that mean that the star is moving that way in space? Explain.

    No. It is going through its life cycle

24. What is a brown dwarf? Why are there no main sequence stars that are less than 0.08 M⊙?

    Too small to be a star. "failed" off the HR Diagram. Not enough mass to be on the main sequence

25. In comparing two different star clusters, you notice that one appears redder and has mostly red stars in it, and the other appears bluer and has mostly blue stars in it. How do the ages of the two clusters compare?

    The bluer are younger. Red stars are further along in the life cycle.

26. What is a planetary nebula?

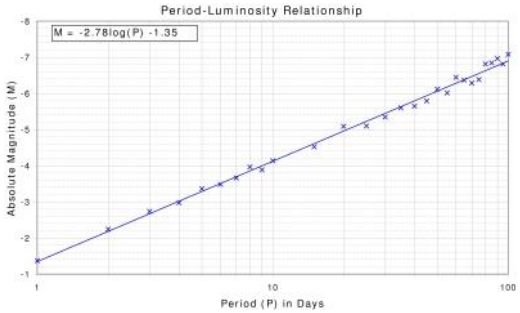
    When the star sheds its outer shell

27. What supports the collapse of white dwarf stars? Are they burning anything? What will eventually happen to them?

    Degenerate electrons. No, they radiate their energy. Will fade out over time.

28. What is the Chandrasekhar limit for white dwarf stars?

    1.4 solar masses



29. What is a Cepheid variable star? Why are Cepheid variables important to astronomers?

    A star that oscillates. Serve as a distance marker

30. In comparing two different Cepheids, you notice that star A has a period of 10 days, while star B has a period of 20 days. How do the luminosities of the two stars compare?

    Star A is brighter because it is burning its fuel quicker.

31. High mass stars will eventually fuse nuclear fuels up to a certain element. What is that element?

    Iron

32. What happens to a high mass star ***after*** that element is formed in the core? What else comes out of this event?

    The gas shell is ejected

33. What is the difference between a Type Ia supernova and a Type II supernova?

    Type I no hydrogen, 4 billion x more luminous than the sun, decline rapidly at first then more steady

    Type II hydrogen 0.6 billion x more luminous than the sun decline to stand still fade rapidly

34. What is a neutron star?

    Extremely dense star that has shed its outer layers

35. What is a pulsar? Sketch a label the parts of a pulsar.

    A neutron star that rapidly spins.

36. What is the light house model of a pulsar? Why do pulsars spin so fast?

    The rapid rotation of the pulsar that emits a detectable signal only when it aligns with the observer. Spin speed is a result of the shifting of electromagnetic forces.

37. What do large masses do to spacetime?

    Bends it

38. What is a black hole? Sketch and label the parts surrounding a black hole.

    A dense star that continues to collapse. Density and gravity prevent light from escaping- light bends in on itself

39. If we can't see the light coming from black holes, then how do we know they exist?

    Accretion disk, galactic jets, x-rays coming from disk, companion star orbiting "nothing"

40. What is the event horizon of a black hole? What is the singularity?

    Ring around a black hole that prevents light from escaping collapsing to zero radius

41. What is a gamma ray burst (aka—a hypernova)?

    Massive star exhausts nuclear fuels, explodes and collapses directly into a black hole

42. Your friend argues that our Sun will eventually explode one day in a supernova and become a black hole. How do you respond?

    No it will not. It will become a white dwarf.

43. Another friend argues that black holes are only theoretical and that they are not real objects. How do you respond?

    Yes they are real objects but they are not actual holes