The following should give you a bit of a sampling of the types of test questions I may ask and serve as a review for the topics we've discussed so far this semester. On the test I will supply you with any tables of data, equations, or constants that you could need to complete the questions. For the sake of this review, I'm assuming you can use your book to look these types of things up. You'll likely want to work these through on your own paper except where you need to draw on an image, as I didn't leave you much room...

1. The core of the Sun is:
    - A. at the same temperature and density as its surface.
    - B. at the same temperature but much denser than its surface.
    - C. much hotter and much denser than its surface.
    - D. constantly rising to the surface through convection.
    - E. composed of iron.
2. What keeps the Sun's outer layers from continuing to fall inward from gravitational collapse?
    - A. Outward pressure due to super-heated gas
    - B. The strong force between protons
    - C. Electromagnetic repulsion between protons
    - D. Neutrinos produced by nuclear fusion drag gas outward
3. What is the only force that can overcome the repulsion between two positively charged nuclei to bind them together into an atomic nucleus?
    - A. The strong force
    - B. The weak force
    - C. The electromagnetic force
    - D. The gravitational force
    - E. The Coriolis force
4. List the different layers of the Sun, and write a short description of what is happening or what is special about each.
5. How does the Sun primarily produce energy?
    - A. Nuclear fusion through a proton-proton chain
    - B. Nuclear fusion through the CNO cycle
    - C. Nuclear fission
    - D. The burning of highly flammable hydrogen
6. Suppose the Sun ran out of fuel and stopped energy production. How long would it take the last neutrinos to reach Earth? How long would it take the last bits of sunlight to reach Earth?
7. How many hydrogen atoms does it take to create one helium atom via the proton-proton chain? What else is created in the process?
8. What would happen in the Sun if the temperature of the core decreased?
    - A. The fusion rate decreases, then the core shrinks and heats
    - B. The fusion rate decreases, then the core expands and heats
    - C. The fusion rate increases, then the core expands and cools
    - D. The fusion rate increases, then the core shrinks and heats

9. What is the solar wind?
10. A computer salesman attempts to convince you to purchase a "solar neutrino" shield for your new computer. Why do you turn down this offer?
    - A. Neutrinos rarely, if ever, interact with your computer
    - B. There is no such thing as a solar neutrino
    - C. Solar neutrinos are generated by solar winds, but we are in a solar minimum currently, so the risk of damage is very low
    - D. The Earth's magnetic field already offers excellent protection against the onslaught of solar neutrinos
11. Star A has an apparent magnitude of 5.6 while Star B has an apparent magnitude of 7.1.
    - (a) Which star appears brighter in the sky?
    - (b) Which star has a higher luminosity?
        - A. Star A
        - B. Star B
        - C. The have the same luminosity
        - D. It is impossible to tell
12. What are the standard units for apparent *brightness*?
    - A. Watts
    - B. Joules
    - C. Newtons
    - D. Watts per second
    - E. Watts per square meter
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14. Sirius has an apparent magnitude of about -1.46. How many times brighter does Sirius appear in the sky than the star Vega?
15. You measure the parallax angle of the Star Arcturus to be $0.0889''$. How far away is Arcturus in light-years?
16. What are the two different methods to calculate a star's luminosity? (*Hint: one depends on its apparent brightness here at Earth and one depends on its temperature*)
17. What are the major spectral types, in order from hottest to coldest?
18. Sketch an HR diagram, and mark and label the following areas:
    - (a) Main sequence stars
    - (b) Giants
    - (c) White dwarfs

(d) Where are high mass stars on the main sequence?

(e) The path a G-type star would follow throughout its lifetime

19. How can you tell the age of a star cluster?

20. What is the source of luminosity for proto-stars that have not yet become hot enough for fusion in their cores?
    A. Fission from concentrated radioactive elements
    B. Light absorbed from nearby stars
    C. Energy released by in-falling matter
    D. Fusion in their low-density outer layers

21. What is the minimum mass a proto-star can have to start fusion and become a main sequence star?

22. What is the fate of an isolated brown dwarf?
    A. It will become a white dwarf.
    B. It will become a neutron star.
    C. It will become a black hole.
    D. It will remain a brown dwarf.

23. Describe degeneracy pressure and how it differs from gas pressure. How do both depend on temperature?

24. What happens when a star like the Sun exhausts its core hydrogen supply?
    A. Its core contracts, but its outer layers expand and the star becomes bigger and brighter
    B. It contracts, becoming smaller and dimmer
    C. It contracts, becoming hotter and brighter
    D. It expands, becoming bigger but dimmer
    E. It contracts, but its outer layers expand and the star becomes bigger but cooler and therefore remains at the same brightness

25. What is a planetary nebula?
    A. A disk of gas surrounding a proto-star that may form into planets
    B. What is left of its planets after a low-mass star has ended its life
    C. The expanding shell of gas that is no longer gravitationally bound to the remnant of a low-mass star
    D. The molecular cloud from which proto-stars form
    E. The expanding shell of gas that is left when a white dwarf explodes as a supernova

26. Compared to the star it evolved from, a white dwarf is:
    A. hotter and brighter.
    B. hotter and dimmer.
    C. cooler and brighter.
    D. cooler and dimmer.
    E. the same temperature and brightness.

27. Describe in words the life-cycle of a high mass star, from beginning to end.

28. Suppose the star Betelgeuse were to become a supernova tomorrow (as seen here on Earth). What would it look like to the naked eye?

A. Because the supernova destroys the star, Betelgeuse would disappear from view
B. We'd see a cloud of gas expanding away from where Betelgeuse used to be. Over a few weeks, this cloud would grow to fill our entire sky.
C. Betelgeuse would remain a dot of light, but would suddenly become so bright that, for a few weeks, we'd be able to see this dot in the daytime
D. Betelgeuse would suddenly appear to grow larger in size, soon reaching the size of the full moon. It would also be about as bright as the full moon.

29. How and from what process do we get elements heavier than Iron?

30. Why is Iron the end of the road for fusion in massive stars?

31. Describe two possible events for a white dwarf in a binary system that is stealing mass from another star. What triggers each event?

32. White dwarfs are supported against gravity primarily by:
    A. electron degeneracy pressure
    B. neutron degeneracy pressure
    C. gas pressure
    D. rotational pressure

33. Which of the following is closest in size (radius) to a neutron star?
    A. The Sun
    B. The Earth
    C. A city
    D. A football stadium
    E. A basketball

34. Explain what causes the radio pulses that we detect from a pulsar.

35. Which of the following statements about black holes is not true?
    A. If you watch someone else fall into a black hole, you will never see them cross the event horizon. However, they will fade from view as the light they emits becomes more and more redshifted.
    B. If we watch a clock fall toward a black hole, we will see it tick slower and slower as it falls toward the black hole.
    C. The event horizon of a black hole represents a boundary from which nothing can escape
    D. If the Sun magically disappeared and was replaced by a black hole of the same mass, the Earth would soon be sucked into the black hole.
    E. If you fell into a supermassive black hole (so that you could survive the tidal forces), you would experience time to be running normally as you plunged across the event horizon.