AST 301--Review for exam 5

This exam covers all of stellar evolution, described in Chapters 19, 20, and 21, except for the "remnants" like neutron stars and black holes that are discussed in Chapter 22 and will be covered on Exam 6. Nearly all the material was covered in class, *except* that I will leave it to your discretion whether to read the sections describing the phenomena that can occur when stars evolve in binary systems (20.6, 21.1); however you will be *not* be tested on this material.

I strongly recommend that you try all the questions at the end of each chapter; they are nearly all good ones, at the level that will be typical on the exam. Some exceptions are listed below. In fact I will, as usual, take a few of the exam questions from the end-of-chapter and online questions. However I do *not* recommend that you spend most of your study time trying to find the answers to these questions: they should be attempted after you have studied, as a self-test, although a quick look at them might be good to give you an idea of how much you understand.

End of chapter questions, and excluded sections:

Ch.19. Not on exam: Sec. 19.5 Shock Waves and Star Formation
R/D All except 14; TF/MC Not 7, 8, 20.

Ch. 20. Not on exam: 20.6.
R/D All except 5, 10, 17, 19, 20; TF/MC Try them all.

Ch. 21. R/D All except 1, 2, 12; TF/MC Not 1, 2, 5, 11, 12.

A good way to review is to try to "tell the story" of the evolution of stars of different masses, starting with the main sequence phase, making sure you can explain all the stages of evolution and the differences between the evolution of low-mass and high-mass stars. Each time you use some new terminology, e.g. "degenerate core," try to explain what you mean, as if you were explaining this to someone with no background. Try some really simple-sounding questions whose answers are not simple at all. For example, "What is the difference between a brown dwarf and a white dwarf?" As you explain how their similar-sounding names have little to do with anything they have in common, ask yourself if you understand the one basic property that they do have in common, and which controls their futures.

A lot of the reading uses the H-R diagram to describe the evolution of stars. However you DON'T have to memorize the "stages" that the authors describe, not by number—i.e. I won't ask you "In what stage does X occur?" I don't care about the numbers, just that you understand something about the evolution, how a cloud becomes a protostar which becomes a main sequence star which becomes a …

Sample questions are on next page.

Here are some sample questions to see if you are prepared to take the exam. As usual, most of these tend to be a little more difficult than the average exam question.

1. What effect does a magnetic field have on the process of stellar birth?
a) It speeds it up. b) It causes fragmentation.
c) It heats the cloud. d) It opposes the collapse of the cloud.

2. How was the chemical composition of the sun different 3 billion years ago from what it is now?
a. more hydrogen now b. more helium now
c. more heavy elements now d. it won't change until the sun becomes a red giant

3. When a star evolves from the main sequence to the red giant phase
a. the core gets hotter and the luminosity increases.
b. the core gets cooler and the surface gets hotter.
c. the core gets hotter and the luminosity decreases.
d. the core and the surface both get cooler.

4. Which of the following do "open clusters" of stars tell us?
a. They allow us to estimate the size of our Galaxy.
b. As standard candles, they can be used to obtain the distances to other galaxies.
c. That when our galaxy was forming, it had a roughly spherical shape.
d. Star formation has been occurring more or less continuously over the past 10 billion years.

5. Roughly how long does it take a stellar iron core to collapse?
a) One second. b) One year. c) A few million years. d) Forever.

6. Why do the cores of massive stars evolve into iron, but not heavier elements?
a. The attempt of the star to fuse iron disrupts the stability of the core by requiring energy.
b. The temperature never gets high enough to allow the fusion of heavier elements.
c. The star goes supernova before the core has a chance to make heavier elements.
d. Iron does not become degenerate.

7. If the fusion of lighter elements with iron to form still heavier elements does not occur in a star, how is it that stars are able to synthesize many elements heavier than iron?
a. neutron capture in the s-process b. helium capture
c. photodisintegration d. neutronization

8. What is a major reason for believing that nucleosynthesis of some heavy elements occurs in stars by means of neutron capture?
a. Detection of technetium in the atmospheres of some red giant stars.
b. Detection of the neutrino burst from SN 1987A.
c. The fact that there is a peak in the cosmic abundance pattern at iron.
d. The discovery of pulsars, which are neutron stars.
e. The statement is not true—heavy elements are not made by neutron capture.