

ASTR 311 STELLAR ASTROPHYSICS
Crucial Study Hints for Exam #3

As you go through the book and notes, I want you to concentrate on several crucial things that are likely to be on the exam. Remember, the purpose for this section of the course was to study (1) stellar structure, (2) energy generation and nucleosynthesis in stars, (3) stellar evolution, and (4) star formation.

- (1) Stellar Structure. What are the equations, and what do they mean? What additional constraints or boundary conditions are needed to "solve" them? Look at the plots of the solar interior structure. Be able to compare and contrast the internal structure of stars of different masses and at different stages in their evolution.
- (2) How does fusion operate in stars, and how do we know? How does it produce the elements heavier than hydrogen? Review the PP chain and the homework. You should also have a basic familiarity with the basic nuclear reactions that drive nucleosynthesis (fission, fusion, alpha, beta, and gamma decay, neutron capture). When are neutrinos produced in nuclear reactions? How does the energy produced in the reaction manifest itself? Under what conditions do the PP, CNO, and 3-alpha processes occur inside stars? Why are Carbon, Nitrogen, and Oxygen produced in such great quantity that they dominate the chemistry (along with hydrogen) in our solar system and throughout most of the universe?
- (3) By now, you should be experts on every part of the HR diagram. How do you represent the various phases of stellar evolution in terms of their observed properties on the HR diagram? How long does each evolutionary phase last? What is going on in the core of the star at each of these phases? At what stages does the interior become fully (or mostly) convective? How do the life histories of low-mass, intermediate-mass, and high-mass stars differ?
- (4) How are the conditions for stability against collapse derived, and what do they mean? How does fragmentation work? What are the observational constraints on this whole process?
- (5) Of course, by now you should also be experts on your star.