

Assignment # 7
Due Friday, November 13, 2009

Instructions

On this and future assignments, please write your name on all pages and staple all pages together. Write very clearly!

Please be sure to explain your answer to all word problems briefly but carefully, and to show all your work on the calculations. The grade on each problem will reflect more the verbal explanations and the calculations shown rather than the final answers given in the back. (In fact, the answers to most of the quantitative questions from the book are given in the back and I'll give you the answers to most of my quantitative questions right on the assignments).

You may work with others on the homework problems, but you must write them up yourself, using your own words and calculations. If you hand in a paper nearly identical to someone else's, neither of you will get any credit because we won't know whether or not you actually did the work.

Also, the solutions will be shown on our class website very soon after the due date: <http://www.ucsb.physics.edu/~astro1/fall2009>. Partly for this reason, we **cannot accept late homework! (Only exception: if you have an emergency and tell me before the due date).**

We will only grade a few problems in detail for 10 points and check to see if you've made a reasonable attempt on the others for the remaining 5 points.

SHOW ALL WORK

1. We can figure out the conditions inside the Sun! There are seven unknowns, which characterize the matter in each layer, including temperature, density, pressure, energy generation rate, etc. We also have seven equations from the laws of physics, which connect these seven quantities. State and briefly explain the three most important equations:
 - a. Hydrostatic Equilibrium
 - b. Equation of State (pressure formula)
 - c. How nuclear energy generation depends on density and temperature (for this only a qualitative answer is expected)
2. Consider a main sequence star of mass 60 times the mass of the Sun and a luminosity of approximately 10^6 times the luminosity of the Sun (see table 19-1). At what rate does mass vanish as H is fused to He in the star's core (4.2×10^{15} kg/sec)? At what rate is H converted into He (6.0×10^{17} kg/sec)? Assuming that

only the 10% of the star's mass in the central regions will get hot enough for fusion, then calculate the main sequence lifetime of the star. Put your answer in years, and compare to the lifetime of the Sun (for the 60 solar mass star, 2.0×10^{13} sec, or only about 625,000 years!).

3. Ch 19: #4, 9, 10

4. Ch 19: #13, 16, 17, 18

5. Visit <http://antwarp.gsfc.nasa.gov/apod/astropix.html> . Go into the archive (click on Discover the Cosmos!) and look at some pictures, which have descriptions from professional astronomers. Pick two especially beautiful ones and explain them in your own words. You can base your explanation on the text provided, but do not copy any part of it.