

AS102 - Homework Assignment #6

Due: no later than 5:00pm on Friday, April 2, 2010

Be sure to put your homework in the right slot of the Homework Box

Chapter 17, pgs. 584-585

Quick Quiz questions (7 points each): 28, 30, 33, 35

Quantitative Problems:

49 (9 points)

52 (9 points)

54 (9 points)

Questions related to material in Ch. 18

Quick Quiz questions (7 points each)

1. Which of the following objects has the highest density? (a) Earth, (b) a $1 M_{\text{sun}}$ white dwarf, (c) a $2 M_{\text{sun}}$ neutron star
2. Which of the following objects is rotating the fastest? (a) the pulsar at the center of the Crab nebula, (b) the sun, (c) Earth
3. As time goes by, which of the following will decrease for a white dwarf? (a) temperature and radius, (b) luminosity and temperature, (c) luminosity and radius
4. An important difference between novae and supernovae is that novae (a) may occur more than once for the same star, (b) completely destroy their parent stars, (c) cause the formation of neutron stars

Quantitative Problems:

5. In the triple-alpha process, the net result is that 3 helium nuclei are fused, resulting in 1 carbon nucleus and some energy. The mass of 1 helium nucleus is 6.643×10^{-27} kg and the mass of 1 carbon nucleus is 1.9926×10^{-26} kg. **(8 points total)**
 - a) Compute the amount of mass that is lost in one triple-alpha reaction. Express your final answer in Joules. (Hint: be sure not too round your numbers by too much.)
 - b) Compute the amount of energy gained from one triple-alpha reaction. Express your final answer in Joules.
 - c) How many times must the triple-alpha reaction run to produce as much energy as one proton-proton chain reaction (for which the energy gained is 4.23×10^{-12} J)?
6. When the sun first becomes a white dwarf, its temperature will be about 600 million Kelvin (6×10^8 K) and its radius will be about the same as the Earth's radius (6371 km). Compared to its present-day luminosity, how bright will the sun be when it first becomes a white dwarf (i.e., compute a ratio)? **(9 points)**

Notes:

- When you answer the Quick Quiz questions, write down the letter for your answer (e.g., “a”, “b”, or “c”) **AND** explanation for why the letter you chose is the correct answer. Your explanation of your answer is worth 4 of the 7 points for each question.
- On the quantitative problems **show all of your work**. If you just write down an answer and don’t show how you got it, you will receive a grade of zero.
- Be sure to include **units of measurement** as appropriate to your solution for quantitative problems.
- If a quantitative problem asks you to “compare” two values, you should **compute a ratio**.
- You may need to use the book to look up some numbers to solve the quantitative problems.