ASTRONOMY 211 S. Balbus
Problem Set#5 Assigned: 27 October 2004 Due: 3 November 2004

1. Shu, problem 6.1

2. Shu, problem 6.9. When Shu says "calculus provides a factor of 2", derive the formula in question by using calculus. Complete the rest of the problem.

3. About 25% of the visible mass of the universe is helium. If most of the visible mass of the universe is in stars similar to or slightly less massive than the sun, why is it that the bulk of this helium cannot be the product of stellar nucleosynthesis? Be *clear*. Your reasoning should be very short and simple.

4. The equation of hydrostatic equilibrium is

$$\frac{dP}{dr} = -\frac{GM(r)\rho}{r^2}$$

Consider the case of a star in which the density ρ is a power law, $\rho = \alpha r^{-p}$ (α is constant.) What is $M(r)$ in this case? If the star has radius R and the pressure P vanishes at $r = R$, what is the central pressure of the star, P_c? Are the mathematical restrictions on p? If so, what are they?

5. Shu, problem 6.12.