

# AST 231: Problem Set 6

Your Name Goes Here

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**Problem 1.** Pre-main sequence stars in their T Tauri phase are believed to be fully convective and, therefore, they satisfy the equation of state appropriate to an adiabatic zone through their entire volume. Also, their central densities are not high enough to make degeneracy effects important, so we can assume that the ideal gas law applies. Finally, they are still chemically homogeneous, so we can assume that they have a Population I chemical composition (say,  $X = 0.73$ ,  $Y = 0.25$  and  $Z = 0.02$ ) throughout. With these assumptions, create a stellar model for a pre-main sequence star with characteristics similar to a typical T Tauri star, namely mass = 0.5 solar masses, effective temperature = 4000 K and luminosity = 1 solar luminosity. Plot the density, pressure and temperature of this star as a function of distance from the center. [Note: While it is true that pressure depends on density to the  $5/3$  power in this star, just like in the low mass white dwarf, the equation of state is not identical to that case. This star is NOT supported by electron degeneracy and you cannot use the value of  $K$  given in Problem Set 6. This question is different, and we have not specified  $K$ . Instead we have specified the mass, luminosity and effective temperature that your model must match. It will be acceptable to have a model that comes close to the specified values of mass, temperature and luminosity even if it does not match them precisely.]

**Answer 1.** Your answer goes here.