Stellar Evolution – Hints to exercises – Chapter 8

8.1 **Homologous contraction(1)**

Discuss your answers to this question with your fellow students or with the teaching assistant. Also see the text of Chapter 8.

8.2 **Homologous contraction(2)**

(a) Combine the homology relation for the density, $\rho \propto M/R^3$, and for the pressure, $P \propto GM^2/R^4$, and apply them to the center of the star. See Section 7.4.

(b)

$$CG\,M^{2/3}\rho_c^{4/3} = \frac{\mathcal{R}\rho_c T_c}{\mu} + K_{\mathrm{NR}}\left(\frac{\rho_c}{\mu_e}\right)^{5/3}$$

therefore

$$T_c = \frac{\mu}{\mathcal{R}}\left(CG\,M^{2/3}\rho_c^{1/3} - \frac{K_{\mathrm{NR}}}{\mu_e^{5/3}}\,\rho_c^{2/3}\right)$$

(c) The maximum is located where $\mathrm{d}T_c/\mathrm{d}x = 0$, taking $x = \rho_c$. Subsititute the resulting x back into the equation for T_c. This yields the same result as eq. (8.5).

8.3 **Application: Minimum core mass for Helium burning**

Hand-in exercise.