Homework #3 Solutions

1. From the notes, examine the relations for T_{eff} as functions of Z and L. You will note that for a fixed T_{eff}, increasing Z results in increasing L, since $L \propto Z^{1/4-1/5}$ roughly. Therefore, the Pop II M-S must lie below the Pop I M-S where Z is larger.

2. The electrostatic energy is given by the general relation

$$E = \int \frac{q\left(r\right) dq\left(r\right)}{r}$$

where $q(r)$ is the charge enclosed in the volume within the radius r. We have

$$q\left(r\right) = eZ\left[\left(\frac{r}{R}\right)^3 - \left(\frac{r}{R_c}\right)^3\right], \qquad dq = 3eZr^2\left[\frac{1}{R^3} - \frac{1}{R_c^3}\right], \qquad r < R,$$

$$q\left(r\right) = eZ\left[1 - \left(\frac{r}{R_c}\right)^3\right], \qquad dq = -3eZ\frac{r^2}{R_c^3}, \qquad R < r < R_c$$

The first term of the second line comes from the protons in the inner sphere. Divide the integration into the two regions, and the requested result will follow.