HW 9-3 Soln)

In the previous problem, the speed of the electron was found to be about $1.1\times10^{+6}$ m/s, or $\beta = 0.004$. The approximation for relativistic energy for 'slowly' moving objects is

$$K \approx \left(\frac{1}{2}\left(\frac{v}{c}\right)^2 + \frac{3}{8}\left(\frac{v}{c}\right)^4 + \cdots\right) m_o c^2 .$$

The shift in the energy level due to relativistic effects is approximately

$$\frac{\frac{3}{8}\left(\frac{v}{c}\right)^4 m_o c^2}{\frac{1}{2}\left(\frac{v}{c}\right)^2 m_o c^2} \approx \left(\frac{v}{c}\right)^2 = \beta^2 = 0.004^2 = 0.002\% .$$

This is just about the discrepancy noted in the discussion.