12.58. **Visualize:** Please refer to Figure P12.58.

Solve: The gravitational force on one of the masses is due to the star *and* the other planet. Thus

$$G\frac{Mm}{r^2} + \frac{Gmm}{(2r)^2} = \frac{mv^2}{r} = \frac{m}{r}\left(\frac{2\pi r}{T}\right)^2 \Rightarrow \frac{GM}{r} + \frac{Gm}{4r} = \frac{4\pi^2 r^2}{T^2}$$

$$\frac{G}{r}\left(M + \frac{m}{4}\right) = \frac{4\pi^2 r^2}{T^2} \Rightarrow T = \left[\frac{4\pi^2 r^3}{G}\frac{1}{(M + m/4)}\right]^{1/2}$$