Chapter 13 Problem 40

Calculate the sun's mass Based on the earth's orbit.

(Data from Appendix D) $r_{es} = 1.496 \times 10^{11}\ m$

$M_s = 1.99 \times 10^{30}\ kg$

from $T^2 = \frac{4\pi^2 r^3}{GM}$

$$M = \frac{4\pi^2 r^3}{G T^2}$$

Now $1\ year = 1\ yr\left(\frac{365.25\ day}{1\ yr}\right)\left(\frac{24\ hr}{1\ day}\right)\left(\frac{3600\ s}{1\ hr}\right)$

$1\ year = 3.16 \times 10^7\ s$ $3.156 \times 10^7\ s$ (Go with 4 sig figs)

Then $M_{sun} = \frac{4\pi^2 (1.496 \times 10^{11}\ m)^3}{\left(6.67 \times 10^{-11} \frac{N m^2}{kg^2}\right)(3.156 \times 10^7\ s)^2}$

$= \boxed{1.9895 \times 10^{30}\ kg}$

This is within the report significant digits of the value given in Appendix D.