**Solution:** (a) Since there are $60 \text{s/minute}$, and $60 \text{ minutes/hour}$, and $24 \text{ hr/day}$, and $365.25 \text{ day/year}$, the distance light travels in a year is

$$2.98 \times 10^8 \text{ m/s} \cdot 60.0 \text{ s/min} \cdot 60.0 \text{ min/hr} \cdot 24.0 \text{ hr/dy} \cdot 365.25 \text{ dy/yr} \cdot 1.00 \text{ yr} = 9.40 \times 10^{15} \text{ m}.$$

(b) Now, $1.0 \text{ AU} = 1.50 \times 10^8 \text{ km}$, or

$$1.0i \text{AU} = 1.50 \times 10^8 \text{ km} \cdot 1.000 \times 10^3 \text{ m/km} = 1.50 \times 10^{11} \text{ m}.$$

Thus, a light-year is

$$9.40 \times 10^{15} \text{ m} \cdot \frac{1.0 \text{AU}}{1.50 \times 10^{11} \text{ m}} = 6.27 \times 10^5 \text{AU}.$$

(c) Thus, light goes $6.27 \times 10^5 \text{ AU/year}$. Converting this to AU/hr we get

$$6.27 \times 10^5 \text{AU/yr} \cdot \frac{1 \text{ yr}}{365.25 \text{ day}} \cdot \frac{1 \text{ day}}{24 \text{ hr}} = 7.15 \text{ AU/hr}.$$

**Problem 26**

Problem: Estimate the number of times a human heart beats in a lifetime.

**Solution:** Your heart beats approximately once per second. There are $60 \text{ seconds/minute}$, $60 \text{ minutes/hour}$, $24 \text{ hours/day}$, $365.25 \text{ days/year}$, and approximately $75 \text{ years/lifetime}$. Therefore, the number of heartbeats in a lifetime is:

$$1/\text{s} \cdot 60 \text{ s/min} \cdot 60.0 \text{ min/hr} \cdot 24.0 \text{ hr/dy} \cdot 365.25 \text{ dy/yr} \cdot 75 \text{ yr/lifetime}$$

$$= 2.37 \times 10^{9} \text{/lifetime},$$

or 2.37 billion heartbeats in a lifetime.