

Chapter 1 Problem 40 †

Given

$$d_{es} = 1.5 \times 10^{11} \text{ m}$$

Solution

a) Find the average speed of the earth as it orbits the sun.

First calculate the circumference of the earth orbit.

$$C = 2\pi r = 2\pi(1.5 \times 10^{11} \text{ m}) = 9.4 \times 10^{11} \text{ m}$$

It takes one year for the earth to orbit the sun. Find the number of seconds in a year.

$$1 \text{ year} \left(\frac{365.25 \text{ day}}{1 \text{ year}} \right) \left(\frac{24 \text{ hr}}{1 \text{ day}} \right) \left(\frac{60 \text{ min}}{1 \text{ hr}} \right) \left(\frac{60 \text{ s}}{1 \text{ min}} \right) = 3.16 \times 10^7 \text{ s}$$

Velocity is distance divided by time.

$$v = \frac{d}{t} = \frac{9.4 \times 10^{11} \text{ m}}{3.16 \times 10^7 \text{ s}} = 2.97 \times 10^4 \text{ m/s}$$

b) Convert this speed into miles per hour.

Convert seconds into hours and meters into miles using $1 \text{ hr} = 3600 \text{ s}$ and $1 \text{ mi} = 1600 \text{ m}$.

$$v = 2.97 \times 10^4 \text{ m/s} \left(\frac{1 \text{ mi}}{1600 \text{ m}} \right) \left(\frac{3600 \text{ s}}{1 \text{ hr}} \right) = 6.7 \times 10^4 \text{ mi/hr}$$

†Problem from University Physics by Ling, Sanny and Moebs (OpenStax)