Exercise 1.10

The following conversions occur frequently in physics and are very useful. (a) Use 1 mi = 5280 ft and 1 h = 3600 s to convert 60 mph to units of ft/s. (b) The acceleration of a freely falling object is 32 ft/s^2. Use 1 ft = 30.48 cm to express this acceleration in units of m/s^2. (c) The density of water is 1.0 g/cm^3. Convert this density to units of kg/m^3.

Solution

Start from the given quantities and go from there.

Part (a)

$$\frac{60\ \cancel{\text{mi}}}{1\ \cancel{\text{hour}}} \times \frac{1\ \cancel{\text{hour}}}{3600\ \text{s}} \times \frac{5280\ \text{ft}}{1\ \cancel{\text{mi}}} = 88\ \frac{\text{ft}}{\text{s}}$$

Part (b)

$$\frac{32\ \cancel{\text{ft}}}{1\ \text{s}^2} \times \frac{30.48\ \cancel{\text{cm}}}{1\ \cancel{\text{ft}}} \times \frac{1\ \text{m}}{100\ \cancel{\text{cm}}} \approx 9.8\ \frac{\text{m}}{\text{s}^2}$$

Part (c)

$$1.0\ \frac{\cancel{\text{g}}}{\cancel{\text{cm}^3}} \times \frac{1\ \text{kg}}{1000\ \cancel{\text{g}}} \times \left(\frac{100\ \cancel{\text{cm}}}{1\ \text{m}}\right)^3 = 1.0 \times 10^3\ \frac{\text{kg}}{\text{m}^3}$$