Exercise 1.59

(**a**) How many liters of wine can be held in a wine barrel whose capacity is 31 gal? (**b**) The recommended adult dose of Elixophyllin®, a drug used to treat asthma, is 6 mg/kg of body mass. Calculate the dose in milligrams for a 185-lb person. (**c**) If an automobile is able to travel 400 km on 47.3 L of gasoline, what is the gas mileage in miles per gallon? (**d**) When the coffee is brewed according to directions, a pound of coffee beans yields 50 cups of coffee (4 cups = 1 qt). How many kg of coffee are required to produce 200 cups of coffee?

Solution

Part (a)

Convert from gallons to liters using dimensional analysis.

$$31 \text{ gal} \times \frac{3.7854 \text{ L}}{1 \text{ gal}} \approx 1.2 \times 10^2 \text{ L}$$

Part (b)

Use dimensional analysis, starting with the given quantity, 185 lb of body mass.

$$185 \text{ lb body mass} \times \frac{453.59 \text{ g body mass}}{1 \text{ lb body mass}} \times \frac{1 \text{ kg body mass}}{1000 \text{ g body mass}} \times \frac{6 \text{ mg Elixophyllin}}{1 \text{ kg body mass}} \approx 5 \times 10^2 \text{ mg Elixophyllin}$$

Part (c)

Convert from kilometers per liter to miles per gallon using dimensional analysis.

$$\frac{400 \text{ km}}{47.3 \text{ L}} \times \frac{3.7854 \text{ L}}{1 \text{ gal}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} \times \frac{1 \text{ ft}}{12 \text{ in}} \times \frac{1 \text{ mi}}{5280 \text{ ft}} \approx 19.8912 \ \frac{\text{mi}}{\text{gal}}$$

If the uncertainty is in the hundreds place (400), then the answer is

$$2 \times 10^1 \ \frac{\text{mi}}{\text{gal}};$$

if the uncertainty is in the tens place (400), then the answer is

$$2.0 \times 10^1 \ \frac{\text{mi}}{\text{gal}};$$

and if the uncertainty is in the ones place (400), then the answer is

$$1.99 \times 10^1 \ \frac{\text{mi}}{\text{gal}}.$$

Part (d)

Use dimensional analysis, starting with the given quantity, 200 cups of coffee.

$$200 \ \underline{\text{cups coffee}} \times \frac{1 \ \overline{\text{lb coffee}}}{50 \ \underline{\text{cups coffee}}} \times \frac{453.59 \ \overline{\text{g coffee}}}{1 \ \overline{\text{lb coffee}}} \times \frac{1 \ \text{kg coffee}}{1000 \ \overline{\text{g coffee}}} \approx 1.8 \ \text{kg coffee}$$