Exercise 1.23

In Wagner's opera *Das Rheingold*, the goddess Freia is ransomed for a pile of gold just tall enough and wide enough to hide her from sight. Estimate the monetary value of this pile. The density of gold is 19.3 g/cm^3, and its value is about \$10 per gram (although this varies).

Solution

Convert the given mass density into dollars per cubic feet.

$$19.3 \frac{\cancel{g}}{\cancel{\text{cm}^3}} \times \frac{\$10}{1\ \cancel{g}} \times \left(\frac{2.54\ \cancel{\text{cm}}}{1\ \cancel{\text{in}}}\right)^3 \times \left(\frac{12\ \cancel{\text{in}}}{1\ \text{ft}}\right)^3 \approx 5.47 \times 10^6\ \frac{\$}{\text{ft}^3}$$

Note that each conversion factor has a value of 1, so they can be squared or cubed without changing anything. Now multiply this monetary density by Freia's volume—approximately that of a rectangular box 5 ft × 2 ft × 2 ft—to get the ransom value.

$$5.47 \times 10^6\ \frac{\$}{\cancel{\text{ft}^3}} \times 5\ \cancel{\text{ft}} \times 2\ \cancel{\text{ft}} \times 2\ \cancel{\text{ft}} \approx \$10^8\ (100 \text{ million dollars})$$