

Exercise 1.24

You are using water to dilute small amounts of chemicals in the laboratory, drop by drop. How many drops of water are in a 1.0-L bottle? (*Hint:* Start by estimating the diameter of a drop of water.)

Solution

Let's say the diameter of a drop of water is 0.15 inches. Divide it by 2 to get the radius,

$$r = \frac{0.15}{2} = 0.075 \text{ in,}$$

and use the formula for the volume of a sphere.

$$\begin{aligned} V &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3}\pi(0.075)^3 \text{ in}^3 \end{aligned}$$

The number of drops in a 1.0-L bottle can now be estimated. Use Appendix E for the conversion factors of volume.

$$\frac{1 \text{ drop}}{\frac{4}{3}\pi(0.075)^3 \text{ in}^3} \times \left(\frac{1 \cancel{\text{in}}}{2.54 \cancel{\text{cm}}}\right)^3 \times \left(\frac{1000 \cancel{\text{cm}^3}}{1 \text{ L}}\right) \approx 3.4 \times 10^4 \frac{\text{drops}}{\text{L}}$$

The fraction representing a conversion factor can be squared or cubed because it has a numerical value of 1.