Exercise 1.13

Figure 1.7 shows the result of unacceptable error in the stopping position of a train. (a) If a train travels 890 km from Berlin to Paris and then overshoots the end of the track by 10 m, what is the percent error in the total distance covered? (b) Is it correct to write the total distance covered by the train as 890,010 m? Explain.

Solution

The percent error is given by the following formula.

$$\text{Percent Error} = \frac{\text{Observed Value} - \text{True Value}}{\text{True Value}} \times 100\%$$

Plugging in the numbers gives

$$\text{Percent Error} = \frac{890{,}010 \text{ m} - 890{,}000 \text{ m}}{890{,}000 \text{ m}} \times 100\% \approx 0.0011\%.$$

It's not correct to write the total distance as 890,010 m because the uncertainty here lies in either the tens place or the ones place. The original distance of 890 km = 890,000 m has uncertainty in either the thousands or the ten thousands place. Scientific notation is needed to specify exactly where the uncertainty lies.