

Section 1.3 The Role of Units in Problem Solving

1. Sometimes, highway signs indicate distances to the upcoming exits in both miles and kilometers. One such distance is given as 17.0 miles. What is this distance in kilometers?

24 CHAPTER 1/INTRODUCTION AND MATHEMATICS

2. A 747 jetliner is cruising at a speed of 520 miles per hour. What is its speed in kilometers per hour?

3. How many seconds are there in (a) one hour and thirty-five minutes and (b) one day?

4. The distance of the Boston marathon is 26 miles, 385 yards. What is the length of this race in meters?

5. A swimming pool has a volume of 4050 ft³. What is the volume in cubic meters (m³)?

6. The largest diamond ever found had a size of 3106 carats. One carat is equivalent to a mass of 0.200 g. Use the fact that 1 kg (1000 g) has a weight of 2.205 lb under certain conditions, and determine the weight of this diamond in pounds.

7. The following are dimensions of various physical parameters that will be discussed later on in the text. Here [L], [T], and [M] denote, respectively, dimensions of length, time, and mass.

	<i>Dimension</i>
Mass (<i>m</i>)	[M]
Speed (<i>v</i>)	[L]/[T]
Acceleration (<i>a</i>)	[L]/[T] ²
Force (<i>F</i>)	[M][L]/[T] ²
Energy (<i>E</i>)	[M][L] ² /[T] ²

Which of the following equations are dimensionally correct?

- (a) $F = ma$ (d) $E = max$
 (b) $x = \frac{1}{2}at^3$ (e) $v = \sqrt{Fx/m}$
 (c) $E = \frac{1}{2}mv$

8. Consider the equation $v = \frac{1}{2}zxt^2$. The dimensions of the variables x , v , and t are [L], [L]/[T], and [T], respectively. What must be the dimensions of the variable z , such that both sides of the equation have the same dimensions? Show how you determined your answer.

*9. The depth of the ocean is sometimes measured in fathoms (1 fathom = 6 feet). Distance on the surface of the ocean is sometimes measured in nautical miles (1 nautical mile = 6076 feet). The water beneath a surface rectangle 1.20 nautical miles by 2.60 nautical miles has a depth of 16.0 fathoms. Find the volume of water (in cubic meters) beneath this rectangle.

*10. Acceleration is the rate of change of the velocity. The acceleration of a car can be expressed in units of miles/hour/hour (or mi/h²). Another unit for acceleration is meters/second/second (or m/s²). Convert an acceleration of 85 mi/h² to units of m/s².