



Figure 9

When determining area by multiplying measurements of length and width, be sure the measurements are expressed in the same units.

(b)

$$\begin{array}{r}
 2035 \text{ cm} \\
 \times 12.5 \text{ m} \\
 \hline
 1017.5 \\
 4070 \\
 \hline
 2035 \\
 25437.5 \\
 \hline
 \text{about } ?? \\
 \underline{2.54 \times 10^4 \text{ cm} \cdot \text{m}}
 \end{array}$$

(c)

$$\begin{array}{r}
 20.35 \text{ m} \\
 \times 12.5 \text{ m} \\
 \hline
 10.175 \\
 40.70 \\
 \hline
 203.5 \\
 254.375 \\
 \hline
 \text{about } \checkmark \\
 \underline{2.54 \times 10^2 \text{ m}^2}
 \end{array}$$

Both dimension and units must agree

Measurements of physical quantities must be expressed in units that match the dimensions of that quantity. For example, measurements of length cannot be expressed in units of kilograms because units of kilograms describe the dimension of mass. It is very important to be certain that a measurement is expressed in units that refer to the correct dimension. One good technique for avoiding errors in physics is to check the units in an answer to be certain they are appropriate for the dimension of the physical quantity that is being sought in a problem or calculation.

In addition to having the correct dimension, measurements used in calculations should also have the same units. As an example, consider **Figure 9(a)**, which shows two people measuring a room to determine the room's area. Suppose one person measures the length in meters and the other person measures the width in centimeters. When the numbers are multiplied to find the area, they will give a difficult-to-interpret answer in units of $\text{cm} \cdot \text{m}$, as shown in **Figure 9(b)**. On the other hand, if both measurements are made using the same units, the calculated area is much easier to interpret because it is expressed in units of m^2 , as shown in **Figure 9(c)**. Even if the measurements were made in different units, as in the example above, one unit can be easily converted to the other because centimeters and meters are both units of length. It is also necessary to convert one unit to another when working with units from two different systems, such as meters and feet. In order to avoid confusion, it is better to make the conversion to the same units before doing any more arithmetic.