

**PHYSICS SKILL****Factor-Label Method for Converting Units**

A very useful method of converting one unit to an equivalent unit is called the factor-label method of unit conversion. You may be given the speed of an object as 25 km/h and wish to express it in m/s. To make this conversion, you must change km to m and h to s. In algebra, you learned that if a quantity is multiplied by 1, its value does not change. But 1 is just a quantity divided by its equivalent. Since  $1000 \text{ m} = 1 \text{ km}$  and  $60 \text{ s} = 1 \text{ min}$  and  $60 \text{ min} = 1 \text{ h}$ ,

$$\frac{1000 \text{ m}}{1 \text{ km}} = 1 \quad \frac{1 \text{ min}}{60 \text{ s}} = 1 \quad \frac{1 \text{ h}}{60 \text{ min}} = 1$$

To change 25 km/h to m/s, you must multiply by a series of factors so that the units you do not want will cancel out and the units you want will remain.

$$\frac{25 \cancel{\text{ km}}}{1 \cancel{\text{ h}}} \times \frac{1000 \text{ m}}{1 \cancel{\text{ km}}} \times \frac{1 \cancel{\text{ h}}}{60 \cancel{\text{ min}}} \times \frac{1 \cancel{\text{ min}}}{60 \text{ s}} = 69 \text{ m/s}$$

To convert 80 milliliters to liters, first choose the factor. Since  $1 \text{ L} = 1000 \text{ mL}$ ,

$$\frac{1 \text{ L}}{1000 \text{ mL}} = 1$$

Use this factor for your conversion as follows.

$$\frac{80 \cancel{\text{ mL}}}{1} \times \frac{1 \text{ L}}{1000 \cancel{\text{ mL}}} = 0.08 \text{ L}$$

**Problems**

Carry out the following conversions using the factor-label method.

- How many seconds are in a year?
- Convert 28 km to cm.
- Convert 50 g to kg.
- Convert 45 kg to mg.
- Convert 450 m/s to m/h.
- Convert 50 liters to mL.
- Convert 85 cm/min to m/s.
- Convert the speed of light,  $3.0 \times 10^8 \text{ m/s}$ , to km/day.