Problem 28

The following masses are written using metric prefixes on the gram. Rewrite them in scientific notation in terms of the SI base unit of mass: the kilogram. For example, 40 Mg would be written as 4×10^4 kg. (a) 23 mg; (b) 320 Tg; (c) 42 ng; (d) 7 g; (e) 9 Pg.

Solution

The prefixes and their meanings are listed in Figure 1.2 on page 17.

$$23 \text{ mg} = 2.3 \times 10^1 \cancel{\text{mg}} \times \frac{1 \cancel{\text{g}}}{10^3 \cancel{\text{mg}}} \times \frac{1 \text{ kg}}{10^3 \cancel{\text{g}}} = 2.3 \times 10^{-5} \text{ kg}$$

$$320 \text{ Tg} = 3.2 \times 10^2 \cancel{\text{Tg}} \times \frac{10^{12} \cancel{\text{g}}}{1 \cancel{\text{Tg}}} \times \frac{1 \text{ kg}}{10^3 \cancel{\text{g}}} = 3.2 \times 10^{11} \text{ kg}$$

$$42 \text{ ng} = 4.2 \times 10^1 \cancel{\text{ng}} \times \frac{1 \cancel{\text{g}}}{10^9 \cancel{\text{ng}}} \times \frac{1 \text{ kg}}{10^3 \cancel{\text{g}}} = 4.2 \times 10^{-11} \text{ kg}$$

$$7 \text{ g} = 7 \cancel{\text{g}} \times \frac{1 \text{ kg}}{10^3 \cancel{\text{g}}} = 7 \times 10^{-3} \text{ kg}$$

$$9 \text{ Pg} = 9 \cancel{\text{Pg}} \times \frac{10^{15} \cancel{\text{g}}}{1 \cancel{\text{Pg}}} \times \frac{1 \text{ kg}}{10^3 \cancel{\text{g}}} = 9 \times 10^{12} \text{ kg}$$