

Problem 20

(a) Calculate the number of cells in a hummingbird assuming the mass of an average cell is 10 times the mass of a bacterium. (b) Making the same assumption, how many cells are there in a human?

Solution

According to Figure 1.4 on page 10,

$$\text{mass of bacterium} = 10^{-15} \text{ kg}$$

$$\text{mass of hummingbird} = 10^{-2} \text{ kg}$$

$$\text{mass of human} = 10^2 \text{ kg.}$$

Then the mass of an atom in the hummingbird (human) is $10 \times 10^{-15} \text{ kg} = 10^{-14} \text{ kg}$. Divide the hummingbird (human) mass by the atomic mass to get the number of atoms.

$$\# \text{ of atoms in hummingbird} = \frac{\text{Hummingbird Mass}}{\text{Hummingbird Atomic Mass}} \approx \frac{10^{-2} \text{ kg}}{10^{-14} \text{ kg}} = 10^{12}$$

$$\# \text{ of atoms in human} = \frac{\text{Human Mass}}{\text{Human Atomic Mass}} \approx \frac{10^2 \text{ kg}}{10^{-14} \text{ kg}} = 10^{16}$$