

## 6.3: Counting Objects By Weighing

The sizes of atoms and molecules are so small that it is physically difficult, if not impossible, to directly count them out (Figure 6.3.1). However, atoms and molecules may be counted indirectly by using a common trick of "counting by weighing."

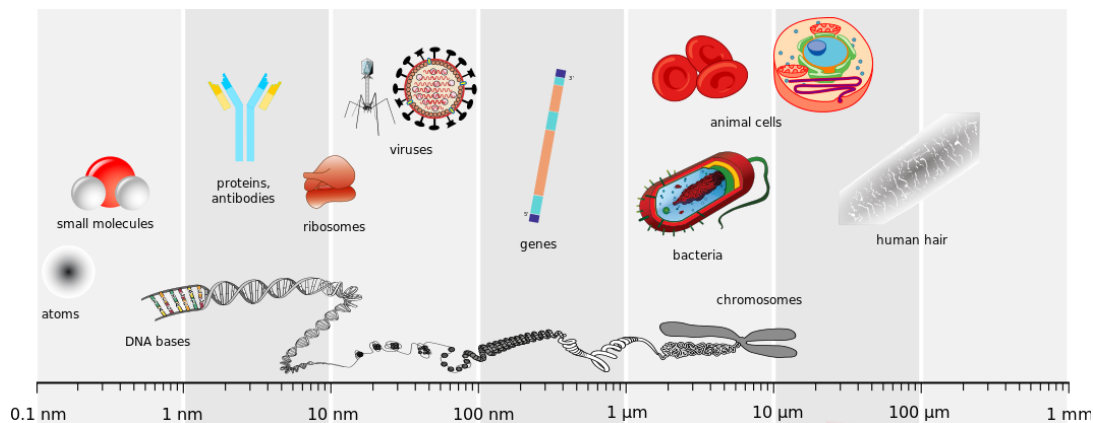


Figure 6.3.1: A comparison of scale. (CC BY-SA 3.0; Wikipedia)

### Counting by Weighing

Consider the example of counting nails in a large box at a hardware store. You need to estimate the number of nails in a box. The weight of an empty box is 113 g and the weight of the box plus a bunch of big nails is 1340 g. Assume that we know that the weight of one nail is 0.450 g. Hopefully it's not necessary to tear open the package and count the nails. We agree that

$$\text{mass of nails} = 1340 \text{ g} - 113 \text{ g} = 1227 \text{ g}$$

Therefore

$$\text{nails in box} = \frac{1227 \text{ g}}{0.450 \text{ g/nail}} = 2,726.7 \text{ nails} = \boxed{2,730 \text{ nails}}$$

You have just counted the number of nails in the box by weighing them (rather than by counting them individually).

### Exercise 6.3.1

Suppose you wanted to know how many pennies dated between 1983 and today were in your coin collection. To save time, you placed them onto a balance with a plastic pan that had already been tared. If it is known that all pennies minted since 1983 have a mass of 2.5 g, how many pennies dated between 1983 and today are shown on the balance below if they have a combined mass of 124.9 g?



**Answer**

50 pennies

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