Lesson 11: Efficacy of the Scientific Notation

Classwork

Exercise 1

The mass of a proton is:

$$0.000000000000000000000000001672622\ kg$$

In scientific notation it is:

Exercise 2

The mass of an electron is:

$$0.000000000000000000000000000000910938291\ kg$$

In scientific notation it is:

Exercise 3

Write the ratio that compares the mass of a proton to the mass of an electron.

Exercise 4

Compute how many times heavier a proton is than an electron (that is, find the value of the ratio). Round your final answer to the nearest one.

Example 2

The U.S. national debt as of March 23, 2013, rounded to the nearest dollar, is $16,755,133,009,522. According to the 2012 U.S. census, there are about 313,914,040 U.S. citizens. What is each citizen's approximate share of the debt?

$$\begin{aligned}\frac{1.6755 \times 10^{13}}{3.14 \times 10^{8}} &= \frac{1.6755}{3.14} \times \frac{10^{13}}{10^{8}} \\ &= \frac{1.6755}{3.14} \times 10^{5} \\ &= 0.533598\ldots \times 10^{5} \\ &\approx 0.5336 \times 10^{5} \\ &= 53360\end{aligned}$$

Each U.S. citizen's share of the national debt is about $53,360.

Exercise 5

The geographic area of California is $163{,}696$ sq. mi, and the geographic area of the US is $3{,}794{,}101$ sq. mi. Let's round off these figures to 1.637×10^5 and 3.794×10^6. In terms of area, roughly estimate how many Californias would make up one US. Then compute the answer to the nearest ones.

Exercise 6

The average distance from Earth to the moon is about 3.84×10^5 km, and the distance from Earth to Mars is approximately 9.24×10^7 km in year 2014. On this simplistic level, how much further is when traveling from Earth to Mars than from Earth to the moon?

Problem Set

1. There are approximately 7.5×10^{18} grains of sand on Earth. There are approximately 7×10^{27} atoms in an average human body. Are there more grains of sand on Earth or atoms in an average human body? How do you know?

2. About how many times more atoms are in a human body, compared to grains of sand on Earth?

3. Suppose the geographic areas of California and the US are $1.637\ x\ 10^5$ and $3.794\ x\ 10^6$ sq. mi, respectively. California's population (as of 2012) is approximately $3.804\ x\ 10^7$ people. If population were proportional to area, what would be the US population?

4. The actual population of the US (as of 2012) is approximately 3.14×10^8. How does the population density of California (i.e., the number of people per sq. mi) compare with the population density of the US?