Lesson 11: Efficacy of Scientific Notation

Classwork

Exercise 1

The mass of a proton is

0.000 000 000 000 000 000 000 000 001 672 622 kg.

In scientific notation it is

Exercise 2

The mass of an electron is

0.000 000 000 000 000 000 000 000 000 000 910 938 291 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 (i.e., 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?

$$\frac{1.6755 \times 10^{13}}{3.14 \times 10^{8}} = \frac{1.6755}{3.14} \times \frac{10^{13}}{10^{8}}$$

$$= \frac{1.6755}{3.14} \times 10^{5}$$

$$= 0.533598\ldots \times 10^{5}$$

$$\approx 0.5336 \times 10^{5}$$

$$= 53360$$

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 U.S. 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 U.S. 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 farther is traveling from Earth to Mars than from Earth to the moon?
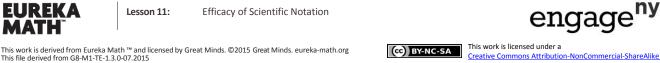
Problem Set

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 U.S. are 1.637×10^5 and 3.794×10^6 sq. mi., respectively. California's population (as of 2012) is approximately 3.804×10^7 people. If population were proportional to area, what would be the U.S. population?

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