

## Unit 1 – Lesson 8

Name: \_\_\_\_\_

### Estimating Quantities

Date: \_\_\_\_\_ Period: \_\_\_\_\_

Focus Standard:	8.EE.A.3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. <i>For example, estimate the population of the United States as <math>3 \times 10^8</math> and the population of the world as <math>7 \times 10^9</math>, and determine that the world population is more than 20 times larger.</i>
	8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

### Student Outcomes

- Students compare and estimate quantities in the form of a single digit times a power of 10.
- Students use their knowledge of ratios, fractions, and laws of exponents to simplify expressions.

### Classwork

#### Exercise 1

The Federal Reserve states that the average household in January of 2013 had \$7,122 in credit card debt. About how many times greater is the U.S. national debt, which is \$16,755,133,009,522? Rewrite each number to the nearest power of 10 that exceeds it, and then compare.

### Exercise 2

There are about 3,000,000 students attending school, kindergarten through Grade 12, in New York. Express the number of students as a single-digit integer times a power of 10.

The average number of students attending a middle school in New York is  $8 \times 10^2$ . How many times greater is the overall number of K–12 students compared to the average number of middle school students?

### Exercise 3

A conservative estimate of the number of stars in the universe is  $6 \times 10^{22}$ . The average human can see about 3,000 stars at night with his naked eye. About how many times more stars are there in the universe compared to the stars a human can actually see?

### Exercise 4

The estimated world population in 2011 was  $7 \times 10^9$ . Of the total population, 682 million of those people were left-handed. Approximately what percentage of the world population is left-handed according to the 2011 estimation?

**Exercise 5**

The average person takes about 30,000 breaths per day. Express this number as a single-digit integer times a power of 10.

If the average American lives about 80 years (or about 30,000 days), how many total breaths will a person take in her lifetime?

## Problem Set

1. The Atlantic Ocean region contains approximately  $2 \times 10^{16}$  gallons of water. Lake Ontario has approximately 8,000,000,000 gallons of water. How many Lake Ontarios would it take to fill the Atlantic Ocean region in terms of gallons of water?

2. U.S. national forests cover approximately 300,000 square miles. Conservationists want the total square footage of forests to be  $300,000^2$  square miles. When Ivanna used her phone to do the calculation, her screen showed the following:



What does the answer on her screen mean? Explain how you know.

Given that the U.S. has approximately 4 million square miles of land, is this a reasonable goal for conservationists? Explain.

3. The average American is responsible for about 20,000 kilograms of carbon emission pollution each year. Express this number as a single-digit integer times a power of 10.

The United Kingdom is responsible for about  $1 \times 10^4$  kilograms of carbon emission pollution each year. Which country is responsible for greater carbon emission pollution each year? By how much?