Giving Meaning to Large Numbers
Physics and Mathematics of Sustainable Energy
Friday, September 16, 2021
College of the Atlantic

The **goals** for today are for you to practice:

- Several techniques for giving meaning to very large numbers,
- Working with scientific notation,
- Thinking about how to communicate approximate quantities.

Guidelines

- Please work in pairs or trios. When you are done, please scan this worksheet (as a pdf if at all possible), and upload to google classroom.
- This assignment is not graded, but I will look these over. I'm asking you to submit this mainly so that I can see how folks are doing in general, what questions people have, etc.

Names: _____

Team Name: _____

These questions explore a number of different ways to make large numbers relatable and understandable.

1. Visualizing numbers

   (a) Draw a number line from the left side of this page to the right side. Let the left side be 0 and the right side be represent 100. On the number line, draw , label 1, 10, and 50.

   (b) Draw a number line from 0 to one billion. On that number line, represent the numbers one million, two million, and 10 million.

2. Time....

   (a) How many days are in a million seconds?

   (b) How many years are in a billion seconds?

   (c) How many years are in a trillion seconds?

3. The 2018 US national budget is around 4.4 trillion dollars. Included in this is 886 billion in military spending. US foreign aid (non-military) is around 33 billion.

   (a) Convert all these numbers to per person.
   (b) Briefly discuss the relative size of these numbers.

4. The net worth[1] of Jeff Bezos, the chairman of Amazon, is 185 billion US dollars. Amazon was founded 27 years ago. At what rate, in dollars per second, did Bezos accumulate wealth over these 27 years?

5. Repeat the above question but for a wealthy person from the US who might have a net worth of one million dollars after 30 years of work.

Digits

Answer these questions as if you were a normal person (i.e., not someone in a physics class.

1. An e-bike can travel at a speed of 15 mph. You want to travel via e-bike to visit your uncle who lives 50 miles away. Your uncle asks how long it will take to get there? How would you answer?

2. You and your friend operate a community kitchen that serves free, vegetarian meals. Today your friend will cook and you are going to the market to buy lentils. You have 40 dollars, and lentils cost three dollars per kilograms. Your friend asks how many kilograms of lentils you'll be able to get. How do you respond?

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[1]As of around a year ago. It's surely gotten even larger over the last year.

Scientific Notation

1. Convert the following numbers to scientific notation:

   (a) 10000

   (b) 0.0004

   (c) 123000000

2. Express the following quantities in Watts:

   (a) 1 MW

   (b) 2.4 GW

   (c) 6×10^5 W

   (d) 14000 kW

3. Express the following quantities in kW:

   (a) 13 MW

   (b) 4 GW

   (c) 2.3×10^4 W

4. Calculate the following, first without, and then with a calculator.

   (a) $(4 \times 10^6) \times (5 \times 10^3)$

   (b) $\frac{20 \times 10^9}{300 \times 10^6}$

   (c) $\frac{250}{10^3}$