

Practice with units and orders of magnitude

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It is a good exercise to convert well known physical parameters into different units, thus making them comparable to other well known units that happen to be measured in these other units. Apart from practice, it sometimes provides remarkable insights almost for free, and it gives us a better appreciation for magnitudes.

1. How far will a million inches get you? And a billion? And a trillion?
(Don't just compute the number, but provide an alternative convenient length to compare to, so that you get a better feel for that number!)
2. What is the mass of a grain of sand? (Of course, grains of sand come in different sizes, so make some reasonable guess and refer to what you comfortably picture as a "grain of sand". Googling the answer will give you a deceptively precise answer that will mean very little to you. Try to do better!)
3. What do a million grains of sand weigh? And a billion? If a truck can carry 10 tons of sand, how many trucks do we need to transport away 1 trillion grains of sand?
4. According to the U.S. Bureau of Engraving and Printing (which belongs to the Department of the Treasury), all U.S. bills weigh the same: one gram—irrespective of denomination.¹ How much does a 600 billion dollar bail-out weigh (if realized in \$100 bills, or if realized in \$1 bills)?
5. What is the speed with which the earth goes around the sun? (Hint: The distance between earth and sun is about 150 million kilometers.)
6. What is your average casual walking speed? If you could walk once around the earth at that speed, how long would it take you? How many seconds is that?
7. How fast do your fingernails grow, or your hair? Convert this into miles per hour.
8. How many nickels do you need to stack on top of each other to get a tower as high as the Empire State Building? Would all these nickels fit into a single room?
9. According to the theory of plate tectonics, South America was in contact with Africa about 135 million years ago. Since then these two continents are drifting apart. What is the average velocity at which this happens? Express this in units that you can relate to!
10. How often will your heart likely beat during your lifetime? If it pumps about 5 liters per minute, how many liters does it pump in a lifetime? How does this compare to the amount of water in an Olympic-size swimming pool?²
11. A one-cent-coin has a diameter of 19.05 mm and a thickness of 1.55 mm; before 1857 they were made out of copper (density: 8.94 g/cm³).³ How many grams would such a cent have? Given the current copper price of about \$5 per kilogram, convince yourself that there is a good reason why modern day cents are made of (much cheaper) zinc with just a thin copper plating!

¹ <https://www.moneyfactory.gov/resources/faqs.html>

² the FINA specifications for an Olympic-size pool are: Length: 50 m, width 25 m, depth: at least 2 m.

³ http://en.wikipedia.org/wiki/Cent_United_States_coin