

A quick introduction to scientific notation

As you saw today, the range of sizes that we'll cover in this class is truly "astronomical." Typical distances between stars are about forty-five quadrillion meters (45,000,000,000,000,000 meters!), the size of the Sun is a 696 million meters (696,000,000 meters), while the size of a hydrogen atom is 53 billionths of a meter (0.00000000053 meters). I don't know about you, but I have trouble even reading the number of zeros in each of these numbers. Fortunately, scientists have developed a short hand way of representing these numbers, called scientific notation.

If you're not familiar with this notation, here's the way it works: when you write a number in scientific notation, you always begin by writing one number to the left of a decimal point. So, in the case of the size of the Sun, you would start by writing "6.96"... but you're not done. In order to indicate how many times you had to move the decimal over in the original number to get 6.96, you add a "power of ten" to the 6.96. In this case, you have to move the decimal point 8 places to the left, so in scientific notation this number is 6.96×10^8 meters (which is read: "*six point nine six times ten to the eight meters*"). If you have to move the decimal place to the right, the power of ten is negative, so in the case of the size of a hydrogen atom, the number would be 5.3×10^{-11} meters (read: "*five point three times ten to the **minus** eleven meters*"). Check the number above to see if I counted the decimal places correctly!

Numbers in scientific notation are pretty easy to multiply or divide. For multiplication, you simply multiply the leading numbers and add the powers of ten. Thus 2×10^9 multiplied by 3×10^4 would just be $(2 \times 3) \times 10^{9+4}$ or 6×10^{13} . Similarly, for division you divide the leading numbers and subtract the powers of ten. So 6×10^5 divided by 2×10^1 would be $(6/2) \times 10^{5-1}$, or 3×10^4 .

A note about scientific notation on calculators: In order to enter a number like 6×10^{13} into a calculator, you have to use a special key, usually the "EE" key, which is your calculator's abbreviation for "*times ten to the*". To enter this number, you would type 6, EE, 13, and the screen of your calculator would read something like "6¹³" or "6.0¹³". If you need help figuring out which key is the right one on your calculator, just ask me.