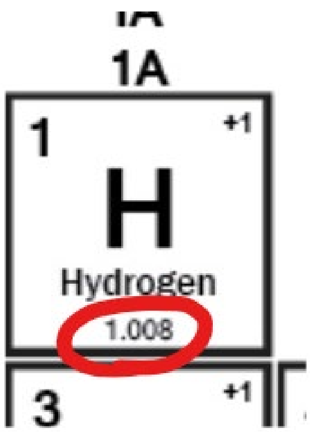
Moles, Molar Mass, and how to use it

1 mol is equal to 6.022×10^{23}. One important feature is that it is **unitless**, effectively it is just a number, if I said I had 1 mol of something it's no different semantically from saying I have a “dozen” of something, ot “one million” of something. Mol does not even specifically denote a number of atoms or particles technically, though it is most commonly used for this purpose.

[For instance, what if we had 1 mol of moles, the burrowing mammal?]

Avogadro's number (6.022×10^{23}) is effectively the number of atoms in one gram of Hydrogen, if all Hydrogens consisted of one proton and one electron. Considering some Hydrogens can have neutrons as well, 1 mol of Hydrogen weighs 1.008 grams instead of 1.000 g. If you have been paying attention in class, you will recognize 1.008 as Hydrogen’s **Atomic Mass or Molar Mass..**



Molar Mass is effectively the mass in grams of **One Mol** of the given atom or molecule. Because atoms have isotopes (same number of protons, different number of neutrons), the molar mass is effectively a factor of the masses of the isotopes as well as their relative abundance on earth. Interestingly, molar mass when measured in this form would slightly differ based on where in the universe you are! It can be calculated with the following formula:

$$\frac{(Mass\ isotope\ 1)(Abundance\ isotope\ 1)\ +\ (Mass\ isotope\ 2)(Abundanc}{n}$$

$$= Molar\ Mass$$

Effectively, multiply the mass of each isotope by their percent abundance, sum the values, and then finally divide the resulting value by the total number of isotopes, n. Remember, the sum of the percent abundances will add up to 1, or 100%. If it does not, either the math is incorrect or an isotope is not accounted for.

If 99% of carbon on earth consisted of Carbon-12, while 1% consisted of Carbon-13, what is the atomic weight?

$$\frac{(12)(0.99)\ +\ (13)(0.01)}{2} = 12.01\ g/mol$$

Other situations in which mols may be used include converting with Avogadro's number. For instance, if you had $1.2044x10^{25}$ bananas, how many mols of bananas do you have?

$$1.2044x10^{24} bananas\ \left(\frac{1\ mol\ bananas}{6.022x10^{23} bananas}\right)$$
$$=\ 2\ mols\ of\ bananas$$