The Mole

The mole concept is far too often misunderstood by far too many. And it need not be this way! Let’s see if the following lines help at all.

As a mole is a certain amount of something, anything, it begs to reason that moles of different things are different in mass: a mole of hydrogen atoms has less mass than a mole of carbon atoms. Why? Because each carbon atom is more massive than each hydrogen atom. And since a mole is an amount of something, equal amounts of unequal things will have different masses. The same goes for a mole of argon atoms being more massive than a mole of carbon atoms.

The mole is associated with Avagadro’s number: 6.02 x 1023. This number is typically going to be used in Chemistry lessons or exams with atoms or molecules. So, one mole of, let’s say oxygen molecules (O2) has 6.02 x 1023  molecules. One-half a mole of O2 has 6.02 x 1023 /2 = 3.01 x 1023 molecules of oxygen.

Keep in mind that as each molecule has 2 atoms, one-half a mole of O2 has 6.02 x 1023 *atoms* of oxygen. With that in mind, 1 mole of oxygen molecules has 2 moles of oxygen atoms. Furthermore, one mole of water molecules (H2O) contains 2 moles of hydrogen (H) atoms and one mole of oxygen atoms.

We cannot measure the mole directly: there is no fancy equipment at our disposal to allow for this. We can however convert from grams to moles if we have a periodic table handy.

Here is the formula: n = m/ M, which can be rearranged to m= n\*M and M= n/m

n= number of moles m= mass M= Molar mass

Importantly in Chemistry, we also need to use moles with solutions, and here is that formula: C = n / V, which can be rearranged as well!

C= Concentration n = number of moles V= volume

These two formulas need to be understood and internalized.

When we understand moles, we can make connections between more theoretical things and practical, meaning we can convert between a number of moles or number of particles (things we cannot measure) and mass (something we can).

This means that we can also use moles and molar ratios to predict masses of products formed when we know the masses of reactants.