THE 'MOLE'

A REVISION POWERPOINT OF THE MOLE IN CHEMISTRY

WHY USE MOLES ?

- In order to answer that question let's relate it to something that almost everybody has heard at some point;

"Which weighs more? A tonne of feathers or a tonne of bricks?"

- The answer (hopefully) is pretty obvious. Both weigh exactly a tonne so neither weighs more than the other.

WHY USE MOLES ?

- In order to answer that question, let's relate it to something that almost everybody has heard at some point;

  "Which weighs more? A tonne of feathers or a tonne of bricks?"
- The answer (hopefully) is pretty obvious. Both weigh exactly one tonne so neither weighs more than the other.
- The material doesn't matter because they weigh the same amount.

- However, let's see what happens if we switch the question around a little bit.

  "Which weighs more? A feather or a brick?"
- Again, this should be pretty simple. This time the answer is the brick. One feather is clearly lighter than one brick.

THE REASON FOR THIS IS THAT THERE IS SIMPLY MORE 'STUFF' IN ONE BRICK THAN IN ONE FEATHER.

ESSENTIALLY, IT'S ALL DOWN TO ATOMS, AND IT IS THE SAME FOR WHEN WE ARE TALKING ABOUT CHEMICALS.

ATOMS AND MOLES

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- In the previous example the brick weighs more than the feather.
- Put simply; this is because the brick has more atoms than the feather.
- Atoms are the building block of molecules which are in turn the building blocks of the feather and brick.

ATOMS AND MOLES

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- Here is a lump of Carbon.
- It has a weight of 74.4 grams.
- It has a mass of 3.73364 x 10^24 atoms.

ATOMS AND MOLES

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- It has a weight of 74.4 grams.
- It has a mass of 3.73364 x 10^24 atoms.

- This is actually the Carbon from the beginning and has a molar mass of 6.2 moles .

A number followed by 'x 10^' means that you add 0 however many times to the end of the first number and get rid of the '.' to show the real number.
For example; 1.2 x 10^2 = 120.
If you were to count up in ones, once every second, it would take you 118,392,947,700,000,000,000,000,000 years to count to 3.73364 x 10^24! That's one hundred eighteen septillion, three hundred ninety-two sextillion, nine hundred forty-seven quintillion, seven hundred quadrillion years!

ATOMS AND MOLES

- Now, this is why moles matter.

- Here is a lump of Carbon.
- It has a mass of 3.73364 x 10^24 (6.2 moles)
- It has a weight of 74.4 grams.

- Here is a lump of Sulphur.
- It has a mass of 3.73364 x 10^24 (6.2 moles)
- It has a weight of 198.4 grams.

DISPITE HAVING THE EXACT SAME NUMBER OF ATOMS, THESE TWO SAMPLES WEIGH COMPLETELY DIFFERENT AMOUNTS.

DEFINING THE MOLE

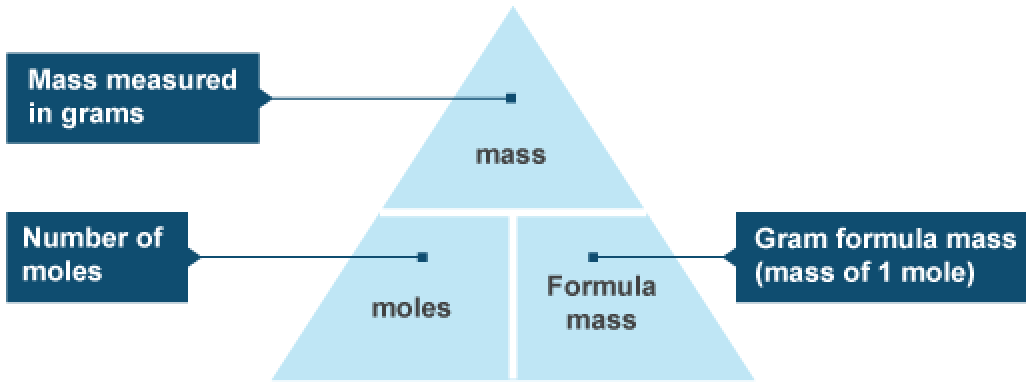
AVOGADRO'S CONSTANT

- The atomic mass unit was developed using the Carbon-12 atom (C-12); the most common isotope of Carbon.

- As Carbon-12 has exactly 6 protons, 6 neutrons and the weight of an electron is almost immeasurably small, 1/12th of the mass of a Carbon-12 atom is therefore very, very close to the mass of a single proton or neutron.

USING MOLAR EQUATIONS

- What on Earth does that mean you are probably asking.



USING MOLAR EQUATIONS

CALCULATIONS

- How do we use this calculation in practice then?
- Here is a completed example:

Q) How many moles are present in 32 grams of Silicone?

A) 32g / 28.0855Mr = 1.139 mole(3dp)*

* 'dp' stands for decimal places.*

USING MOLAR EQUATIONS
CALCULATIONS

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USING MOLAR EQUATIONS CALCULATIONS

Q) How many moles are present in 32 grams of Silicone?

- First and foremost you should always establish what it is you know in the given question.

- What do we know?:

- The chemical we are being asked about is Silicone.
- We know that the mass of the substance is 32 grams.
- We are being asked to calculate the number of moles.

- And we have been given the mass

Moles = 32 grams / Relative Formula Mass

USING MOLAR EQUATIONS

COMPOUNDS

- Worked example:

- Q) Calculate the total mass of 2.1 moles of Carbon-Dioxide (CO2).

- Firstly assess what we know:
- The chemical we are being asked about is Carbon-Dioxide (CO2)
- We know that there is a total of 2.1 moles in the sample.
- We are being asked to calculate the total mass.

- Let's get up our equation:

USING MOLAR EQUATIONS
COMPOUNDS

- This time we are being asked to calculate the mass.

USING MOLAR EQUATIONS
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- This time we are being asked to calculate the mass.
- We must rearrange our equation:
- Next lets plug in what we know:

Mass = 2.1 moles x Relative Formula Mass

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- Total RFM: 0

USING MOLAR EQUATIONS

COMPOUND PRACTICE

- Q1) Calculate the molar mass of a sample of Iron-Oxide (Fe2O3) weighing 6.2 grams.
- Q2) Calculate the molar mass of a sample of Sodium-Chloride (NaCl) weighing 2.7 grams.
- Q3) Calculate the mass of a 4.8 mole sample of Hydrogen-Chloride (HCl).
- Q4) Calculate the molar mass of a sample of Amonia (Nh3) weighing 10.92 grams.
- Q5) State which single element is bonded twice with Oxygen (O) when the overall mass is 41.4345 grams and the molar mass is 2.3 and state the molecule.