**4.3 Molar Mass**

The mass of 1 mole of a particular element or compound is known as its **molar mass.**

Because the particles of different elements or compounds have different masses, the masses of 1 mol of different substances will be different.

Consider the following:

In general:

* The molar mass of an element is the relative atomic mass of the elements expressed in grams.
* The molar mass of a compound is the relative molecular or relative formula mass expressed in grams.

The symbol for molar mass is ***M.*** The unit of measurement of molar mass is ***g mol-1.***

|  |  |  |
| --- | --- | --- |
| Substance | Relative Mass  (no units) | Molar Mass  (M) |
| Hydrogen | Mr(H2) = 2.0 | M(H2) = 2.0 g mol-1 |
| Magnesium | Ar(Mg) = 24.3 | M(Mg) = 24.3 g mol-1 |
| Water | Mr(H2O) = 18.0 | M(H2O) = 18.0 g mol-1 |
| Sodium chloride | RFM(NaCl) = 58.5 | M(NaCl) = 58.5 g mol-1 |
| Carbon dioxide | Mr(CO2) = 44.0 | M(CO2) = 44.0 g mol-1 |

For example: M(CO2) = 44.0 g mol-1 can be interpreted as:

* The molar mass of carbon dioxide is 44 g mol-1 or
* 1 mole of carbon dioxide has a mass of 44 g or
* 6.02 x 1023 molecules of carbon dioxide has a mass of 44g

**Worked example 4.3a**

**Calculate:**

1. **The molar mass of table sugar, sucrose (C12H22O11)**
2. **The mass of 2.5 moles of sucrose.**

A useful formula can be used to link a given mass of a substance (*m*), its molar mass (*M*) and the amount of substance (*n*):

Mass of a given amount of substance (g) = amount of substance (mol) x molar mass (g mol-1)

More simply put: ***m = n x M or n = m / M***

**Worked example 4.3b**

**Calculate the mass of 0.35 mol of magnesium nitrate (Mg(NO3)2).**

**Counting by weight.**

When you use ‘mole’ you are effectively counting the number of particles in a substance. We can now count atoms by weighing and that you can know the number of particles present in a known mass of the substance.

**Worked Example 4.3c**

1. **Calculate the amount (in mol) of CO2 molecules present in 22 g of carbon dioxide**
2. **What is the number of molecules present in this mass of CO2?**

**Worked example 4.3d**

**Amyl ethanoate (C2H14O2) is the compound that gives bananas their characteristic odour, it is also a compound released when bees sting. The odour of the compound is a signal to other bees to come. Each time a bee stings, one-thousandth of a milligram (1.0 x 10-6 g) of amyl ethanoate is released.**

**Calculate:**

1. **The number of amyl ethanoate molecules released in each bee sting**
2. **The total number of atoms present in this number of molecules**

**Text Questions: 9 – 13**

**Worksheet: 8**