

What is Molarity?

Introduction

Molarity is an important concept and is one that needs to be understood as it is a 'cornerstone' of lab research and without a basic understanding of moles and molarity research is not possible.

What is molarity?

Molarity is a measure of concentration. That is all it is, it is the number of moles of something per litre of solution.

A 1 Molar (1 M) solution can be described as:

1 mole of a compound made up to a 1 litre solution

And as one mole is the molecular weight of a compound then it can be also stated that a 1 Molar (1 M) solution as:

The molecular weight of a compound made up to 1 litre

For example:

If you have a compound with a molecular weight of 10 g/mol then 10 g of the compound, which is 1 mole, made up in a 1 litre solution would give a 1 Molar (1 M) solution.

If you took 5 g of the same compound and made up to 1 litre you would have 0.5 M solution (5 g is half a mole of a compound with a molecular weight of 10 g/mol, and that 0.5 mole is in 1 litre).

If you had 10 g of the compound made up to 2 litre you would have 10 g per 2 litres, which is 5 g per litre. As the molecular weight is 10 g/mol then 5 g is 0.5 moles, and as that 0.5 moles are in 1 litre then the concentration is 0.5 Molar (0.5 M).

So, expressed as an equation this means that:

$$M = m / v$$

Where:

M = molarity (M)

m = moles

v = volume (litre)

From the equation in the lecture on moles we know that:

$$m = g / MW$$

Where:

m = moles

g = mass in grams

MW = molecular weight (grams per mole)

So this mean we can substitute for m in the first equation we get:

$$M = m / v$$

As $m = g / MW$, then we get

$$M = (g / MW) / v$$

Which is:

$$M = g / (MW \times v)$$

Where:

M = molarity (M)

g = mass in grams

MW = molecular weight (grams per mole)

v = volume (litre)

In the lab you may be asked to make up a certain volume of a solution at a given molarity. For this you need to rearrange the above equation so that you can solve for grams (g).

Given the equation:

$$M = g / (MW \times v)$$

then a rearrangement for g gives:

$$M \times (MW \times v) = g$$

And tidying up we get:

$$g = M \times MW \times v$$

Where:

g = mass in grams

M = molarity (M)

MW = molecular weight (grams per mole)

v = volume (litre)

You could use the above equations to calculate molarity, but if you remember that:

the molecular weight of a compound dissolved in 1 litre of water is a one molar solution

then you have molarity covered, and you can quickly and easily derive the equations.