Chem12 pH and pOH-60

An important concept in chemistry is the concept of pH and pOH. Before introducing this topic, we must look at the mathematics of logarithms.

Logarithms were invented to make calculations easier. The operation of multiplication can be turned into the less complex operation of addition by using logarithms.

Definition : $\log 10^x = x$.

e.g. $\log 10^4 = 4$, $\log 10^{-3} = -3$, $\log 50. = 1.7$

The above values can be verified by using the **log** button on your calculator.

e.g. Using logarithms is the inverse of using exponents.

e.g. since $10^{-5} \times 10^7 = 10^2$, we can use logs.

e.g. $\log(10^{-5} \times 10^7) = \log(10^2)$

$\log 10^{-5} + \log 10^7 = 2$

$-5 + 7 = 2$

The above equations show how, by using logarithms, multiplication becomes addition. The above rule is generally true. That is : log(AxB) = log A + log B.

In chemistry, the concentration of H_3O^+ in acids can vary from 1.0 mol/L to 10^{-14} mol/L. This very large range can be reduced by taking logs.

e.g. $\log 1.0 = 0.0$, and $\log 10^{-14} = -14$.

Chemists define the following : **pH** = - log $[H_3O^+]$; **pOH** = - log $[OH^-]$.

Exercises :

1) Use your calculator to find the following.

a) log 10^{5}, b) log 10^{-9}, c) log $(2.7x10^{-3})$.

2) Find the pH.

a) $[H_3O^+]$ = 0.00010 M, b) $[H_3O^+]$ = $10.^{-7}$ M, c) $[H_3O^+]$ = $7.4x10^{-2}$ M.

3) Find the pOH.

a) $[OH^-]$ = 1.0 M, b) $[OH^-]$ = $10.^{-9}$ M, c) $[OH^-]$ = $2.8x10^{-6}$ M.

Answers : 1)a) 5, b) -9, c) -2.6, 2)a) 4.0, b) 7.0, c) 1.1, 3)a) 0.0, b) 9.0, c) 5.6.