Base 10 logarithms come into play in connection with the pH concept.

pH = -log[H^+]

Two basic problems: (1) Find pH given [H^+] (units of moles/L or molarity). (2) Find [H^+] given pH.

Basics

The log of any exponential value = the exponent.

Examples: log (10^0) = log (1) = 0. Log (10^3) = log (1000) = 3. Log (10^{-2}) = log (0.01) = -2.

Logarithms were invented to make arithmetic easier. Adding and subtracting is easier than multiplying and dividing.

Examples: Log (xy) = log (x) + log (y). Log (1/y) = -log (y). Log (x/y) = log (x) – log (y).

Solving pH problems

I. Converting [H^+] to pH using your calculator.

What is the pH of 0.015 M HCl? There are two ways to do this. In the first way, you solve by entering the value and then hitting the log function (or the other way around, depending on your brand of calculator). So, log 0.015 = -1.82 (always express pH to the nearest hundredth) and the pH is 1.82.

The second way: express the concentration in scientific notation as 1.5 x 10^{-2}. Then the pH is –{log (1.5) -2}. Find the log of 1.5 on the calculator (= 0,18). So the pH is –(0.18 – 2) = 1.82.

II. Converting pH to [H^+] using your calculator

What is [H^+] if the pH is 7.62? Or, what is the value of $10^{-7.62}$? This requires using the 2ndF mode of the calculator to find the antilog. Every make of calculator seems to require a different sequence of key strokes. On my ancient Sharp calculator, the sequence is as follows:

[2ndF] [Log] [7.62] [Change sign (+/-)] [=] = 2.40 x 10^{-8}.

Here is a way to do it that avoids some of the difficulty and gives the value of the exponent directly without having to do a sign change: First, rearrange to log [H^+] = -7.62. Then break it up: -7.62 = 0.38 -8! (Recall that log (xy) = log (x) + log (y)). Then find the antilog of 0.38: [2ndF] [log] [.38] [=] = 2.40. Then combine to get 2.40 x 10^{-8}.