Summary of Logarithms for pH Calculations

Simply put, logarithms (logs for short) are exponents

Any number can be expressed in logarithmic form ($\log_{base}$ (number) = exponent)

Log_2 (8) = 3 is the same expression as $2^3 = 8$

Log_4(64)= 3 is the same expression as $4^3 = 64$

Since most calculations are done with a base 10, if no base is listed, the base is assumed to be 10.

For example:

Number	Exponential Expression	Logarithm
1000	10^3	3
100	10^2	2
10	10^1	1
1	10^0	0
1/10 = 0.1	10^{-1}	-1
1/100 = 0.01	10^{-2}	-2
1/1000 = 0.001	10^{-3}	-3

Logs are typically done by electronic means … enter the number and hit the log key and the log is displayed

For example:

Log 45.63 = 1.6593
Log 20456.5 = 4.31083
Log 3.500 = 0.544

Application to pH problems: **pH is the negative logarithm of the molar hydrogen ion concentration, $[H^+]$**

To find pH from the hydrogen ion concentration, the formula is

$pH = -\log [H^+]$

To find the pH for a $[H^+]$ of 3.45×10^{-3}

Enter 3.45×10^{-3} into your calculator
Hit your log key … display is -2.46218
Hit change sign key for your calculator … Display is 2.46218

Number of digits to the right of the decimal point is the same as the number of sig figs in the expediential.

3.45×10^{-3} has three sig figs, so decimal portion of log has three digits: 2.462

So, a $[H^+]$ of 3.45×10^{-3} would read as a pH of 2.462

If we are given the pH and need to find the **[**H^+]

We need to find the number (corresponds to [H^+] that is represented by 10^{-pH}

We do this using the anti-log or inverse log function (calculators vary on descriptive terms)

To find the **[**H^+] of a solution having a pH of 2.87

$pH = -\log [H^+] = 2.87$

$\log [H^+] = -2.87$

$[H^+]$ = inv log (-2.87) or $[H^+]$ = antilog (-2.87)

The method of key entry depends on your calculator

You are trying to find the result of $10^{-2.87}$ or the antilog/inverse log of -2.87

$[H^+] = 1.4 \times 10^{-3}$ M

(2 sig. fig. in scientific notation form ‘cause log has 2 digits to the right of the decimal)