Using a Calculator to Calculate pH from $[H_3O^+]$

Most problems involve hydronium ion concentrations that are not equal to integral powers of 10. These problems require a calculator. Most scientific calculators have a "log" key. Consult the instructions for your particular calculator.

An estimate of pH can be used to check your calculations. For example, suppose the $[H_3O^+]$ of a solution is 3.4×10^{-5} M. Because 3.4×10^{-5} lies between 10^{-4} and 10^{-5}, the pH of the solution must be between 4 and 5. Sample Problem C continues the actual calculation of the pH value for a solution with $[H_3O^+] = 3.4 \times 10^{-5}$ M.

SAMPLE PROBLEM C

For more help, go to the Math Tutor at the end of this chapter.

What is the pH of a solution if the $[H_3O^+]$ is 3.4×10^{-5} M?

SOLUTION

1 ANALYZE

Given: $[H_3O^+] = 3.4 \times 10^{-5}$ M
Unknown: pH of solution

2 PLAN

$$[H_3O^+] \longrightarrow \text{pH}$$

The only difference between this problem and previous pH problems is that you will determine the logarithm of 3.4×10^{-5} using your calculator. You can convert numbers to logarithms on most calculators by using the "log" key.

3 COMPUTE

$$\begin{aligned} \text{pH} &= -\log [H_3O^+] \\ &= -\log (3.4 \times 10^{-5}) \\ &= 4.47 \end{aligned}$$

On most calculators, this problem is entered in the following steps.

3 . 4 EE 5 +/− LOG +/−

4 EVALUATE

The pH of a 1×10^{-5} M H_3O^+ solution is 5.0. A solution that has a greater concentration of hydronium ions will be more acidic and will have a pH less than 5. Because the concentration has two significant figures, the pH will have two figures following the decimal point.

PRACTICE

Answers in Appendix E

1. What is the pH of a solution if the $[H_3O^+]$ is 6.7×10^{-4} M?
2. What is the pH of a solution with a hydronium ion concentration of 2.5×10^{-2} M?
3. Determine the pH of a 2.5×10^{-6} M HNO_3 solution.
4. Determine the pH of a 2.0×10^{-2} M $Sr(OH)_2$ solution.

extension

Go to **go.hrw.com** for more practice problems that ask you to calculate pH.

Keyword: HC6ABTX