

## Using a Calculator to Calculate pH from $[\text{H}_3\text{O}^+]$

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  $[\text{H}_3\text{O}^+]$  of a solution is  $3.4 \times 10^{-5}$  M. Because  $3.4 \times 10^{-5}$  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  $[\text{H}_3\text{O}^+] = 3.4 \times 10^{-5}$  M.

### SAMPLE PROBLEM C

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

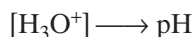
What is the pH of a solution if the  $[\text{H}_3\text{O}^+]$  is  $3.4 \times 10^{-5}$  M?

#### SOLUTION

##### 1 ANALYZE

Given:  $[\text{H}_3\text{O}^+] = 3.4 \times 10^{-5}$  M  
Unknown: pH of solution

##### 2 PLAN



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

##### 3 COMPUTE

$$\begin{aligned}\text{pH} &= -\log [\text{H}_3\text{O}^+] \\ &= -\log (3.4 \times 10^{-5}) \\ &= 4.47\end{aligned}$$

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

##### 4 EVALUATE

The pH of a  $1 \times 10^{-5}$  M  $\text{H}_3\text{O}^+$  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  $[\text{H}_3\text{O}^+]$  is  $6.7 \times 10^{-4}$  M?
2. What is the pH of a solution with a hydronium ion concentration of  $2.5 \times 10^{-2}$  M?
3. Determine the pH of a  $2.5 \times 10^{-6}$  M  $\text{HNO}_3$  solution.
4. Determine the pH of a  $2.0 \times 10^{-2}$  M  $\text{Sr}(\text{OH})_2$  solution.

#### extension

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

 Keyword: HC6ABTX