

Section 9 – 7: Calculator Applications using the Log Function

pH

pH is the measure of the acidity or alkalinity of a solution. For very dilute solutions, the molarity (molar concentration) of H^+ may be used. Pure water at 25 °C has a pH level of 7.0. Solutions with a pH value lower than 7.0 are known as acids. Solutions with a pH value greater than 7.0 are known as bases.

pH formula

In dilute solutions such as tap water, pH is approximately equal to the numeric value of the concentration of the H^+ ion measured in moles per liter therefore pH defines a logarithmic scale of acidity.

$$ph \approx -\log[H^+]$$

where $[H^+]$ is the concentration of Hydrogen ions in moles per liter.

Example 1

Find the pH of a lemonade sample that has an $[H^+]$ concentration of 0.0050 mol/L (moles per liter).

Solution: $ph \approx -\log[.005] = 2.3$

Example 2

Find the pH of a lemonade sample that has an $[H^+]$ concentration of 4.5×10^{-4} mol/L
 4.5×10^{-4} mol/L = .00045 moles per liter

Solution: $ph \approx -\log[.0045] \approx 3.35$

Example 3

Find $[H^+]$ for a solution with pH of 3.2

$$3.2 \approx -\log x$$

$$-3.2 \approx \log x$$

$$10^{-3.2} \approx x$$

$$.00063 \approx x$$

$$[H^+] = 6.3 \times 10^{-4} \text{ mol/L}$$

Example 4

Find $[H^+]$ for a solution with pH of 2.1

$$2.1 \approx -\log x$$

$$-2.1 \approx \log x$$

$$10^{-2.1} \approx x$$

$$.00793 \approx x$$

$$[H^+] = 7.9 \times 10^{-3} \text{ mol/L}$$