

19.2

HYDROGEN IONS AND ACIDITY

Section Review

Objectives

- Classify a solution as neutral, acidic, or basic, given the hydrogen-ion or hydroxide-ion concentration
- Convert hydrogen-ion concentrations into values of pH and hydroxide-ion concentrations into values of pOH
- Describe the purpose of pH indicators

Vocabulary

- self-ionization
- neutral solution
- ion-product constant for water (K_w)
- acidic solution
- basic solution
- alkaline solutions
- pH

Key Equations

- $K_w = [\text{H}^+] \times [\text{OH}^-] = 1.0 \times 10^{-14} \text{M}^2$
- $\text{pH} = -\log [\text{H}^+]$
- $\text{pOH} = -\log [\text{OH}^-]$
- $\text{pH} + \text{pOH} = 14$

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

Water molecules can 1 to form hydrogen ions (H^+) and hydroxide ions (OH^-). The concentrations of these ions in pure water at 25°C are both equal to 2 mol/L.

The pH scale, which has a range from 3, is used to denote the 4 concentration of a solution. On this scale, 0 is strongly 5, 14 is strongly 6, and 7 is 7. Pure water at 25°C has a pH of 8.

The 9 constant for water has a value of 1.0×10^{-14} . Thus, the product of the concentrations of 10 ions and 11 ions in aqueous solution will always equal 1.0×10^{-14} .

- ionize
- 1×10^{-7} mol/L
- 0-14
- H^+
- acidic
- basic
- neutral
- 7
- ion product
- $\text{H}^+ / \text{H}_3\text{O}^+$
- OH^-

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

- AT 12. In an acidic solution, $[H^+]$ is greater than $[OH^-]$.
- NT 13. pH indicators can give accurate pH readings for solutions.
- AT 14. If the $[H^+]$ in a solution increases, the $[OH^-]$ must decrease.
- NT 15. The $[OH^-]$ is less than $10^{-7}M$ in a basic solution.
- NT 16. The definition of pH is the negative logarithm of the hydroxide-ion concentration.

Part C Matching

Match each description in Column B to the correct term in Column A.

- | Column A | Column B |
|---|---|
| <u>c</u> 17. alkaline solutions | a. aqueous solution in which $[H^+]$ and $[OH^-]$ are equal |
| <u>f</u> 18. pH | b. product of hydrogen ion and hydroxide ion concentrations for water |
| <u>e</u> 19. self-ionization | c. base solutions |
| <u>a</u> 20. neutral solution | d. solution in which $[H^+]$ is less than $[OH^-]$ |
| <u>b</u> 21. ion-product constant for water (K_w) | e. reaction in which two water molecules produce ions |
| <u>g</u> 22. acidic solution | f. the negative logarithm of the hydrogen-ion concentration |
| <u>d</u> 23. basic solution | g. solution in which $[H^+]$ is greater than $[OH^-]$ |

Part D Problems

Answer the following in the space provided.

24. Calculate the hydroxide-ion concentration, $[OH^-]$, for an aqueous solution in which $[H^+]$ is 1×10^{-10} mol/L. Is this solution acidic, basic, or neutral?

$$[OH^-] = 1 \times 10^{-4} M$$

Basic

25. Determine the hydrogen-ion concentrations for aqueous solutions that have the following pH values.

a. 3

$$10^{-3} M$$

b. 6

$$10^{-6} M$$

c. 10

$$10^{-10} M$$