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

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

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}.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

Part B True-False

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

_____ **12.** In an acidic solution, $[H^+]$ is greater than $[OH^-]$.

_____ **13.** pH indicators can give accurate pH readings for solutions.

_____ **14.** If the $[H^+]$ in a solution increases, the $[OH^-]$ must decrease.

_____ **15.** The $[OH^-]$ is less than $10^{-7} M$ in a basic solution.

_____ **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

_____ **17.** alkaline solutions

_____ **18.** pH

_____ **19.** self-ionization

_____ **20.** neutral solution

_____ **21.** ion-product constant for water (K_w)

_____ **22.** acidic solution

_____ **23.** basic solution

Column B

a. aqueous solution in which $[H^+]$ and $[OH^-]$ are equal

b. product of hydrogen ion and hydroxide ion concentrations for water

c. base solutions

d. solution in which $[H^+]$ is less than $[OH^-]$

e. reaction in which two water molecules produce ions

f. the negative logarithm of the hydrogen-ion concentration

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?

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

    a. 3   **b.** 6   **c.** 10