

**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**

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

- $pOH = -\log [OH^-]$
- 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 <sup>+</sup> ) and	1
hydroxide ions (OH <sup>-</sup> ). The concentrations of these ions in pure	2
water at 25°C are both equal to $\underline{2}$ mol/L.	3
The pH scale, which has a range from <u>3</u> , is used to	4
denote the <u>4</u> concentration of a solution. On this scale, 0 is	5
strongly <u>5</u> , 14 is strongly <u>6</u> , and 7 is <u>7</u> . Pure	6
water at 25°C has a pH of <u>8</u> .	7
The <u>9</u> constant for water has a value of $1.0 \times 10^{-14}$ .	8
Thus, the product of the concentrations of <u>10</u> ions and	9
ions in aqueous solution will always equal $1.0 \times 10^{-14}$ .	10
	11

#### Part B True-False

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

1	<b>2.</b> In an acidic solution, $[H^+]$ is greater than $[OH^-]$ .
1	<b>3.</b> pH indicators can give accurate pH readings for solutions.
1	<b>1.</b> If the $[H^+]$ in a solution increases, the $[OH^-]$ must decrease.
1	5. The $[OH^-]$ is less than $10^{-7}M$ in a basic solution.
10	<b>5.</b> 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
17.	alkaline solutions a	a.	aqueous solution in which $[H^+]$ and $[OH^-]$ are equal
18.	pH b	).	product of hydrogen ion and hydroxide ion concentrations for water
19.	self-ionization	c.	base solutions
20.	neutral solution	1.	solution in which $[H^+]$ is less than $[OH^-]$
21.	ion-product constant for water $(K_w)$	e.	reaction in which two water molecules produce ions
22.	acidic solution	f.	the negative logarithm of the hydrogen-ion concentration
23.	basic solution g	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  $1 \times 10^{-10}$  mol/L. Is this solution acidic, basic, or neutral?
- 25. Determine the hydrogen-ion concentrations for aqueous solutions that have the following pH values. **b.** 6

**a.** 3