

## 14.1

## HYDROGEN IONS AND ACIDITY

## Section Overview

## Objectives

1. Identify conjugate acid-base pairs of ions, acids, or hydroxides and of aqueous concentrations.
2. Calculate hydroxide and hydronium ion concentrations and pH values and vice versa for a given pH.
3. Calculate the pH of weak acid solutions.

## Vocabulary

- |                   |                                |        |
|-------------------|--------------------------------|--------|
| 1. autoionization | 2. conjugate acid-base pair    | 3. pH  |
| 4. hydronium ion  | 5. hydronium ion concentration | 6. pOH |
|                   | 7. hydroxide ion               |        |

## Key Equations

- |   |   |
|---|---|
| 1. $\text{pH} = -\log[\text{H}_3\text{O}^+]$ (Eq. 14.1) | 2. $\text{pOH} = -\log[\text{OH}^-]$ (Eq. 14.2) |
| 3. $\text{pH} + \text{pOH} = \text{pK}_w$ (Eq. 14.3)    | 4. $\text{pH} + \text{pOH} = 14.00$ (Eq. 14.4)  |

## Part A: Completion

Use the appropriate number to identify the relationship of the conjugate acid-base pair indicated in the second step of the reaction. Complete the reaction.

1.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$  (autoionization of water)
2.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$  (conjugate acid-base pair)
3.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$  (conjugate acid-base pair)
4.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$  (conjugate acid-base pair)
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8.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$  (conjugate acid-base pair)
9.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$  (conjugate acid-base pair)
10.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$  (conjugate acid-base pair)

1.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$
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9.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$
10.  $\text{H}_2\text{O} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$

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