CHAPTER 8 ACID–BASE EQUILIBRIUM

Reflect on Your Learning

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1. The concentration of the hydrogen ion in pure water at SATP is equal to 1.0×10^{-7} mol/L.
   $pH = -\log [H^+_{(aq)}]$
   $= -\log [1.0 \times 10^{-7}]$
   $pH = 7$
2. The pH of hydrochloric acid is lower because $HCl_{(aq)}$ is a stronger acid than acetic acid.
3. The products for the neutralization of $HCl_{(aq)}$ and $NaOH_{(aq)}$ are $NaCl_{(aq)}$ and water. Neither the sodium ion nor chloride hydrolyze to change the pH of water. However, the neutralization of acetic acid with sodium hydroxide produces water and sodium acetate. The acetate ion is a stronger base than chloride and hydrolyzes to release hydroxide ions in solution. The production of hydroxide accounts for why the resulting solution is basic.
4. The blood contains a variety of buffering agents, which resist changes in pH.

Try This Activity: Antacid Equilibrium

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(a) $Mg(OH)_{2(s)} \rightleftharpoons Mg^{2+}_{(aq)} + 2\ OH^-_{(aq)}$

(b) The equilibrium shifts to the right when hydrochloric acid is added. The evidence is the observation that the solution becomes clear, indicating that all the magnesium hydroxide had dissolved.

8.1 THE NATURE OF ACID–BASE EQUILIBRIA

PRACTICE

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Understanding Concepts

1. (a) $HCO^-_{3(aq)}$ / $CO^{2-}_{3(aq)}$ $HS^-_{(aq)}$ / $S^{2-}_{(aq)}$
   (b) $H_2CO_{3(aq)}$ / $HCO^-_{3(aq)}$ $H_2O_{(l)}$ / $OH^-_{(aq)}$
   (c) $HSO^-_{4(aq)}$ / $SO^{2-}_{4(aq)}$ $H_2PO^-_{4(aq)}$ / $HPO^{2-}_{4(aq)}$
   (d) $H_2O_{(l)}$ / $OH^-_{(aq)}$ $H_3O^+_{(aq)}$ / $H_2O_{(l)}$
2. Amphoteric substances in question 1 are $H_2O_{(l)}$, $HCO^-_{3(aq)}$.
3. $H_2CO_{3(aq)}$ / $HCO^-_{3(aq)}$ $HCO^-_{3(aq)}$ / $CO^{2-}_{3(aq)}$

PRACTICE

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Understanding Concepts

4. (a) 0 mol/L
   (b) $[OH^-] = \dfrac{1.0 \times 10^{-14}}{0.30} = 3.3 \times 10^{-14}$ mol/L
5. $$n_{HCl} = \frac{0.37\text{ g}}{36.46\text{ g/mol}}$$
   $$n_{HCl} = 0.010\text{ mol}$$
   $$[H^+] = \frac{0.010\text{ mol}}{250 \times 10^{-3}\text{ L}}$$