## Calculating pH

- 1. What is the pH of the following solutions given their hydronium ion concentrations? (a)  $[H_3O^+(aq)] = 5.32 \times 10^{-7} \text{ mol/L}$ 
  - **(b)**  $[H_3O^+(aq)] = 6.1 \times 10^{-5} \text{ mol/L}$
  - (c)  $[H_3O^+(aq)] = 2.679 \times 10^{-14} \text{ mol/L}$
  - (d)  $[H_3O^+(aq)] = 0.23 \text{ mol/L}$
- 2. Which of the above solutions would be considered acidic?
- **3.** Fill in the following chart:

$[H_3O^+(aq)] (mol/L)$	рН
$1.37 \times 10^{-2}$	
$2.38\times10^{-5}$	
$2.38  imes 10^{-6}$	
$1.00  imes 10^{-7}$	
$3.45 \times 10^{-9}$	
$3.45 \times 10^{-10}$	
$3.45 \times 10^{-11}$	
$5.33 \times 10^{-12}$	

- 4. Notice in the chart that the concentration of  $H_3O^+(aq)$  is continually decreasing. What do you notice about the pH values?
- 5. Generalize what happens to pH as acidity decreases.
- 6. What do you think happens to pH as basicity decreases?
- 7. Find some spots on the table when the pH increases by exactly 1 pH unit. What do you notice about the change in concentration of hydronium ions at these points?

- **8.** What is the pH of a solution made by the following methods?
  - (a) Dissolving 3.62 g of pure hydrogen perchlorate,  $HClO_4(aq)$  (strong acid), in 2.0 L of water.

(b) Dissolving 2.357 g of pure hydrobromic acid, HBr(aq) (strong acid), in 50.0 L of water.

(c) Dissolving 8 µg of pure nitric acid, HNO<sub>3</sub>(aq) (strong acid), in 20.0 mL of water.

## pOH and pH Calculations

- What is the pOH of the following solutions given their hydroxide ion concentrations?
   (a) [OH<sup>-</sup>(aq)] = 4.67 × 10<sup>-3</sup> mol/L
  - **(b)**  $[OH^{-}(aq)] = 5.84 \times 10^{-8} \text{ mol/L}$
  - (c)  $[OH^{-}(aq)] = 1.478 \times 10^{-14} \text{ mol/L}$
  - (d)  $[OH^{-}(aq)] = 3.4 \times 10^{-2} \text{ mol/L}$
- 2. Which of the above solutions are considered acidic?
- **3.** If given the pH of the following solution, give the pOH, or vice versa:

(a) pH = 12.3

- **(b)** pOH = 5.5
- (c) pOH = 2.95
- (**d**) pH = 6.629
- (e) pOH = 1.1
- **4.** Fill in the following chart:

[OH <sup>-</sup> (aq)] mol/L	рОН	pH
1.28		
$5.35  imes 10^{-3}$		
$8.459 \times 10^{-5}$		
$9.6  imes 10^{-8}$		
$1.934  imes 10^{-15}$		

5. What is the pOH of a 3.2 mol/L solution of lithium hydroxide, LiOH(aq)?

6. What is the pOH of a 5.467 mol/L solution of strontium hydroxide, Sr(OH)<sub>2</sub>(aq)?

7. What is the pH of a 3.45 mol/L solution of sodium hydroxide, NaOH(aq)?

**8.** What is the pOH of a solution made by dissolving 4.95 g of potassium hydroxide, KOH(aq), in 4.50 L of water?

## Calculating Concentration from pH and pOH

- What is the concentration of hydronium ions in the following solutions given their pH values?
   (a) pH = 2.34
  - (b) pH = 15.6
    (c) pH = 4.4
    (d) pH = 1.892
    (e) pH = 5.63
- 2. What is the concentration of hydroxide ions in the following solutions given the following information?(a) pOH = 1.45
  - **(b)** pOH = 10.672
  - (c) pOH = 7.3
  - (**d**) pH = 2.982
  - (e) pH = 4.932
  - (f) pH = 10.2
- **3.** What is the concentration of hydrochloric acid, HCl(aq) (strong acid), that gives a solution with a pH of 3.69?

4. What is the concentration of lithium hydroxide, LiOH(aq), that gives a solution with a pOH of 4.674?

5. What is the concentration of barium hydroxide, Ba(OH)<sub>2</sub>(aq), that gives a solution with a pH of 11.836?

**6.** What mass of hydrogen chloride gas, HCl(g) (strong acid), needs to be dissolved in 2.00 L of water to create a solution with a pH of 3.298?

7. What mass of rubidium hydroxide, RbOH(s), needs to be dissolved in 1.50 L of water to create a solution with a pH of 9.35?

**8.** What mass of strontium hydroxide, Sr(OH)<sub>2</sub>(s), needs to be dissolved in 3.0 L of water to create a solution with a pH of 8.34?