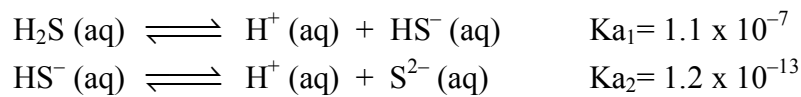


REVIEW QUESTIONS

Chapter 16

1. A 0.10 M solution of lactic acid ( $\text{HC}_3\text{H}_5\text{O}_3$ ) has a pH of 2.44. Calculate  $K_a$  for lactic acid.
2. A 0.200 M solution of a weak acid HX is 9.4% ionized. Calculate the pH and  $K_a$  for this acid.
3. Calculate the pH of a 0.050 M solution of ethylamine ( $\text{C}_2\text{H}_5\text{NH}_2$ ,  $K_b = 6.4 \times 10^{-4}$ ).
4. The  $K_a$  for hydrocyanic acid, HCN, is  $5.0 \times 10^{-10}$ . What is the  $K_b$  for  $\text{CN}^-$ ?

5. Hydrosulfuric acid is a polyprotic acid with the following equilibria:



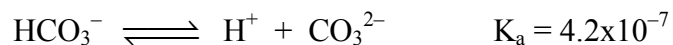
- a) Calculate the pH of a 0.100 M H<sub>2</sub>S solution.
- b) Calculate the [S<sup>2-</sup>] for the solution above.
6. Sodium benzoate, C<sub>6</sub>H<sub>5</sub>CO<sub>2</sub>Na, is the salt of the weak acid, benzoic acid (C<sub>6</sub>H<sub>5</sub>CO<sub>2</sub>H). A 0.10 M solution of sodium benzoate has a pH of 8.60 at room temperature.
- a) Calculate the K<sub>b</sub> value for benzoate ion (C<sub>6</sub>H<sub>5</sub>CO<sub>2</sub><sup>-</sup>).
- b) Calculate the K<sub>a</sub> value for benzoic acid.

7. Potassium sorbate ( $\text{KC}_6\text{H}_7\text{O}_2$ ) is the salt of the weak acid, sorbic acid ( $\text{HC}_6\text{H}_7\text{O}_2$ ,  $K_a = 1.7 \times 10^{-5}$ ), and is commonly added to cheese to prevent mold. What is the pH of a solution containing 4.93 g of potassium sorbate in 500 mL of solution?
8. A buffer is prepared by adding 20.0 g of acetic acid ( $\text{HC}_2\text{H}_3\text{O}_2$ ) and 20.0 g of sodium acetate ( $\text{NaC}_2\text{H}_3\text{O}_2$ ) in enough water to prepare 2.00 L of solution. Calculate the pH of this buffer? ( $K_a = 1.8 \times 10^{-5}$ )
9. What is the ratio of  $\text{HCO}_3^-$  to  $\text{H}_2\text{CO}_3$  in blood of pH 7.4? ( $K_a$  for  $\text{H}_2\text{CO}_3 = 4.3 \times 10^{-7}$ )

10. How many grams of NaBrO should be added to 1.00 L of 0.200 M HBrO to form a buffer with a pH of 8.80? ( $K_a$  for HBrO =  $2.5 \times 10^{-9}$ )

11. Acetylsalicylic acid (aspirin,  $\text{HC}_9\text{H}_7\text{O}_4$ ) is a weak acid with  $K_a = 2.75 \times 10^{-5}$  at  $25^\circ\text{C}$ . 3.00 g of sodium acetylsalicylate ( $\text{NaC}_9\text{H}_7\text{O}_4$ ) is added to 200.0 mL of 0.100 M solution of this acid. Calculate the pH of the resulting solution at  $25^\circ\text{C}$ .

12. The equations and dissociation constants for three different acids are given below:



Identify the conjugate pair that is best for preparing a buffer with a pH of 7.2. Clearly explain your choice.

13. A buffer solution is prepared by adding 0.10 L of 2.0 M acetic acid solution to 0.10 L of 1.0 M NaOH solution.

a) Calculate the pH of this buffer solution.

b) 0.10 L of 0.20 M HCl is added to 0.40 L of the buffer solution above. What is the pH of the resulting solution?

14. A 10.0 mL solution of 0.100 M  $\text{NH}_3$  ( $K_b = 1.8 \times 10^{-5}$ ) is titrated with a 0.100 M HCl solution. Calculate the pH of this solution at equivalence point.

15. A sample of 25.0 mL of 0.100 M solution of HBr is titrated with 0.200 M NaOH. Calculate the pH of solution after 10.0 mL of the base is added.

16. A 10.0-mL solution of 0.300 M  $\text{NH}_3$  is titrated with a 0.100 M HCl solution. Calculate the pH after the following additions of the HCl solution:  
(a) 0.0 mL, (b) 10.0 mL, (c) 30.0 mL

17. A 45.0-mL sample of 0.200 M acetic acid is titrated with 0.180 M NaOH. Calculate the pH of the solution (a) before addition of NaOH, (b) after addition of 20.0 mL of NaOH and (c) at the equivalence point.