Name _____ Date _____ Class _____

18–1 Review and Reinforcement

Defining Acids and Bases

Complete each of the following sentences by filling in the appropriate word or phrase from the list below.

electrolyte
acid-base indicator
neutralization reaction
salt
hydronium ion
amphoteric
conjugate

1. An ionic compound that forms from an acid-base neutralization reaction is a(n) _____.
2. A(n) _____ is a substance that conducts electricity.
3. The chloride ion (Cl^-) is the _____ base of hydrochloric acid (HCl).
4. The formula H_3O^+ represents a(n) _____.
5. A(n) _____ turns one color in an acidic solution and another color in a basic solution.
6. The reaction between an acid and a base is called a(n) _____.

On the line at the left, write "A" if the statement is a property of an acidic solution. Write "B" if it is a property of a basic solution, and write "X" if it is a property of both acidic and basic solutions.

_____ 7. often feels smooth and slippery
_____ 8. has a sour taste
_____ 9. stings in open wounds
_____ 10. typically reacts vigorously with metals
_____ 11. has a bitter taste
_____ 12. turns litmus paper from blue to red
_____ 13. is an electrolyte
_____ 14. often looks like pure water
_____ 15. turns litmus paper from red to blue
_____ 16. typically does not react with metals

Answer the following questions in the space provided.

17. What is the Arrhenius definition of an acid? What is the Arrhenius definition of a base?

_____

_____

_____

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18–1 *Review and Reinforcement (continued)*

18. What is the Brønsted-Lowry definition of an acid? What is the Brønsted-Lowry definition of a base?

19. Why might NH_3 not be considered a base according to the Arrhenius definition?

20. Why is the Brønsted-Lowry definition of acids and bases more encompassing than the Arrhenius definition?

21. Why is the H^+ ion the same as a proton?

Determine the conjugate acid-base pairs in each of the following reactions.

22. $NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$

23. $HNO_2(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + NO_2^-(aq)$

24. $HCN(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + CN^-(aq)$

HYDROLYSIS OF SALTS

Name _____ 3

Salt solutions may be acidic, basic or neutral, depending on the original acid and base that formed the salt.

Strong Acid + Strong Base → Neutral Salt
Strong Acid + Weak Base → Acidic Salt
Weak Acid + Strong Base → Basic Salt

A weak acid and a weak base will produce any type of solution depending on the relative strengths of the acid and base involved.

Complete the table below for each of the following salts.

Salt	Parent Acid	Parent Base	Type of Solution
1. KCl			
2. NH_4NO_3			
3. Na_3PO_4			
4. $CaSO_4$			
5. $AlBr_3$			
6. CuI_2			
7. MgF_2			
8. $NaNO_3$			
9. $LiC_2H_3O_2$			
10. $ZnCl_2$			
11. $SrSO_4$			
12. $Ba_3(PO_4)_2$			

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19–1 Practice Problems

1. What is the concentration of OH^- ions in saturated limewater if $[H_3O^+] = 3.98 \times 10^{-13}$ *M*? Is limewater acidic, basic, or neutral?

2. What is the concentration of H_3O^+ ions in a wheat flour and water solution if $[OH^-] = 1.0 \times 10^{-8}$ *M*? Is wheat flour and water acidic, basic, or neutral?

3. What is the concentration of OH^- ions in a potato and water solution if $[H_3O^+] = 1.6 \times 10^{-6}$ *M*? Are potatoes and water acidic, basic, or neutral?

4. What is the concentration of H_3O^+ ions in 0.1 *M* ammonia if $[OH^-] = 1.26 \times 10^{-3}$ *M*? Is ammonia acidic, basic, or neutral?

5. What is the concentration of OH^- ions in butter if $[H_3O^+] = 6.0 \times 10^{-7}$ *M*? Is butter acidic, basic, or neutral?

6. What is the concentration of H_3O^+ ions in peaches if $[OH^-] = 3.16 \times 10^{-11}$ *M*? Are peaches acidic, basic, or neutral?

7. What is the concentration of OH^- ions in 0.1 *M* borax if $[H_3O^+] = 6.31 \times 10^{-10}$ *M*? Is borax acidic, basic, or neutral?

8. What is the concentration of H_3O^+ ions in eggs if $[OH^-] = 6.0 \times 10^{-7}$ *M*? Are eggs acidic, basic, or neutral?

9. What is the concentration of OH^- ions in 0.1 *M* bicarbonate of soda if $[H_3O^+] = 3.98 \times 10^{-9}$ *M*? Is bicarbonate of soda acidic, basic, or neutral?

10. During the course of the day, human saliva varies between being acidic and basic. What is the concentration of H_3O^+ ions in saliva if $[OH^-] = 3.16 \times 10^{-8}$ *M*? Is this sample of saliva acidic, basic, or neutral?

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19–1 *Practice Problems (continued)*

11. Analysis of a sample of maple syrup reveals that the concentration of OH^- ions is 5.0×10^{-8} *M*. What is the pH of this syrup? Is it acidic, neutral, or basic?

12. In a sample of bananas and water, it is found that $[H_3O^+] = 2.51 \times 10^{-5}$ *M*. What is the corresponding pH value, and are the bananas and water acidic, neutral, or basic?

13. $[OH^-] = 7.94 \times 10^{-12}$ *M* in a sample of vinegar. What is the pH of the vinegar, and is it acidic, neutral, or basic?

14. A sample of human blood plasma is found to have a concentration of H_3O^+ ions of 3.72×10^{-8} *M*. What is the pH of this sample? Is it an acid, a base, or neutral?

15. In a sample of saturated magnesia, it is found that $[OH^-] = 3.22 \times 10^{-4}$ *M*. What is the pH of this sample, and is it acidic, neutral, or basic?

16. Tomatoes are found to have a hydronium ion (H_3O^+) concentration of 6.2×10^{-5} *M*. What is the pH of these tomatoes, and are they acidic, neutral, or basic?

17. A saturated solution of calcium carbonate has a hydroxide concentration of 2.44×10^{-4} *M*. What is the pH of this solution, and is it acidic, neutral, or basic?

18. The hydronium concentration in a urine specimen is measured to be 6.3×10^{-6} *M*. What is the pH of this sample, and is it acidic, neutral, or basic?

19. What is the pH of sour pickles if $[OH^-] = 1.6 \times 10^{-10}$ *M*? Are the pickles acidic, neutral, or basic?

20. The hydroxide content of a popular soft drink is measured and found to be 4.11×10^{-9} *M*. What is the pH of this soft drink, and is it acidic, neutral, or basic?

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19–3 Practice Problems

1. A volume of 30. mL of 0.25 *M* HCl neutralizes a 50. mL sample of KOH solution. What is the concentration of KOH?

2. A volume of 9.0 mL of 0.70 *M* NH_3 neutralizes a 35 mL sample of $HClO_4$ solution. What is the concentration of $HClO_4$?

3. A volume of 90 mL of 0.2 *M* HBr neutralizes a 60 mL sample of NaOH solution. What is the concentration of the NaOH solution?

4. A volume of 37 mL of 0.36 *M* KCN neutralizes a 75-mL sample of HClO solution. What is the concentration of HClO?

5. A volume of 46 mL of 0.40 *M* NaOH neutralizes an 80.-mL sample of HCN solution. What is the concentration of HCN?

6. A volume of 50. mL of 0.30 *M* HCl neutralizes a 60.-mL sample of $Ca(OH)_2$ solution. What is the concentration of $Ca(OH)_2$? (Hint: Each $Ca(OH)_2$ molecule contributes two OH^- ions.)

7. A volume of 20. mL of 0.25 *M* $Al(OH)_3$ neutralizes a 75-mL sample of H_2SO_4 solution. What is the concentration of H_2SO_4? (Hint: Each $Al(OH)_3$ molecule contributes three OH^- ions, and each H_2SO_4 molecule contributes two H_3O^+ ions.)

8. A volume of 135 mL of 0.40 *M* HCl neutralizes a 90.-mL sample of $Ca(OH)_2$ solution. What is the concentration of $Ca(OH)_2$?

9. A volume of 60. mL of 0.60 *M* HBr neutralizes an 80.-mL sample of $Ca(OH)_2$ solution. What is the concentration of $Ca(OH)_2$?

10. A volume of 10. mL of 0.75 *M* NaOH neutralizes a 30.-mL sample of HClO solution. What is the concentration of HClO?