Name ______________________ Date ______________ Class ______________

19.3 STRENGTHS OF ACIDS AND BASES

Section Review

Objectives

- Define strong acids and weak acids
- Calculate an acid dissociation constant (K_a) from concentration and pH measurements
- Order acids by strength according to their acid dissociation constants (K_a)
- Order bases by strength according to their base dissociation constants (K_b)

Vocabulary

- strong acids
- weak acids
- acid dissociation constant (K_a)
- strong bases
- weak bases
- base dissociation constant (K_b)

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

The strength of an acid or a base is determined by the __1__ of the substance in solution. The acid dissociation constant, __2__, is a quantitative measure of acid strength. A strong acid has a much __3__ K_a than a weak acid. The K_a of an acid is determined from measured __4__ values.

Hydrochloric acid and sulfuric acid are __5__ ionized in solution and are __6__ acids. Ethanoic acid, which is only about 1 percent ionized, is a __7__ acid. Magnesium hydroxide and calcium hydroxide are strong __8__.

Weak bases react with __9__ to form the hydroxide ion and the conjugate __10__ of the base. Concentration in solution does not affect whether an acid or a base is __11__ or weak.

1. degree of ionization
2. Ka
3. higher
4. pH
5. completely
6. strong
7. weak
8. bases
9. water
10. acid
11. strong

Name ____________________ Date ______________ Class ______________

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

ST 12. Acids are completely dissociated in aqueous solution.

NT 13. Diprotic acids lose both hydrogens at the same time.

AT 14. Acid dissociation constants for weak acids can be calculated from experimental data.

ST 15. Bases react with water to form hydroxide ions.

Part C Matching

Match each description in Column B to the correct term in Column A.

	Column A	Column B
c	16. strong acids	a. ratio of the concentration of the dissociated (or ionized) form of an acid to the concentration of the undissociated acid
e	17. weak acids	b. bases that dissociate completely into metal ions and hydroxide ions in aqueous solution
a	18. acid dissociation constant (K_a)	c. acids that ionize completely in aqueous solution
b	19. strong bases	d. bases that do not dissociate completely in aqueous solution
d	20. weak bases	e. acids that are only partially ionized in aqueous solution
f	21. base dissociation constant (K_b)	f. ratio of concentration of conjugate acid times concentration of hydroxide ion to the concentration of conjugate base

Part D Problem

Answer the following in the space provided.

22. A 0.35M solution of a strong acid, HX, has a $[H^+]$ of 4.1×10^{-2}. What is the value of K_a for this acid?

$$K_a = \frac{[H^+] \times [X^-]}{[HX]}$$

$$= \frac{(4.1 \times 10^{-2})(4.1 \times 10^{-2})}{0.309}$$

$$= 5.4 \times 10^{-3}$$

$HX = 0.35 - 4.1 \times 10^{-2}$
$= 0.309$

pH = 2.26

Name KEY Date ______ Class ______

19.4 NEUTRALIZATION REACTIONS

Section Review

Objectives

- Explain how acid–base titration is used to calculate the concentration of an acid or a base
- Explain the concept of equivalence in neutralization reactions

Vocabulary

- neutralization reactions
- equivalence point
- standard solution
- titration
- end point

Key Equations

- Acid + Base → Salt + Water
- Gram equivalent mass = $\frac{\text{molar mass}}{\text{number of ionizable hydrogens}}$
- Normality (N) = equiv/L
- $N_1 \times V_1 = N_2 \times V_2$
- $N_A \times V_A = N_B \times V_B$

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

In the reaction of a(n) __1__ with a base, hydrogen ions and __2__ ions react to produce __3__. This reaction, called __4__, is usually carried out by __5__. The __6__ in a titration is the point at which the solution is neutral. At the __7__ point of a titration, the number of equivalents of acid equals the number of equivalents of base.

1. acid
2. hydroxide
3. water
4. neutralization
5. titration
6. end point
7. equivalence

Name ______________________ Date ________________ Class ________________

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

AT 8. A solution of known concentration is called a standard solution.

AT 9. The end point of a titration of a strong base with a strong acid occurs when $[H^+] = [OH^-]$.

AT 10. The point of neutralization is the end point of titration.

NT 11. The reaction of an acid and a base produces only water.

Part C Matching

Match each description in Column B to the correct term in Column A.

	Column A	Column B
c	12. titration	a. when the number of moles of hydrogen ions equals the number of moles of hydroxide ions
e	13. neutralization reactions	b. a solution of known concentration
a	14. equivalence point	c. a process for determining the concentration of a solution by adding a known amount of a standard solution
b	15. standard solution	d. point of neutralization
d	16. end point	e. reactions between acids and bases to produce a salt and water

Part D Problem

Answer the following in the space provided.

17. Complete and balance the equations for the following acid–base reactions.

a. $H_3PO_4 + Al(OH)_3$

$H_3PO_4 + Al(OH)_3 \rightarrow 3H_2O + AlPO_4$

b. $HI + Ca(OH)_2$

$2HI + Ca(OH)_2 \rightarrow 2H_2O + CaI_2$

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19.5 SALTS IN SOLUTION

Section Review

Objectives

- Define when a solution of a salt is acidic or basic
- Demonstrate with equations how buffers resist changes in pH

Vocabulary

- salt hydrolysis
- buffers
- buffer capacity

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

A __1__ forms when an acid is neutralized by a base. Salts can be neutral, __2__, or __3__ in solutions. Salts of strong acid–strong base reactions produce __4__ solutions with water. Salts formed from the neutralization of weak acids or weak bases __5__ water. They produce solutions that are acidic or basic.

For example, the pH of a solution at the equivalence point is greater than 7 for a __6__ base-__7__ acid titration. Solutions that resist changes in pH are called __8__ solutions. The buffer __9__ is the amount of acid or base that can be added to a buffer without changing the pH greatly.

1. salt
2. acidic
3. basic
4. neutral
5. hydrolize
6. strong
7. weak
8. buffer
9. capacity

Name ______________ Date ______________ Class ______________

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

NT 10. An aqueous solution of NH_4Cl is basic.

NT 11. HCl–NaCl would be a good buffer system.

ST 12. A buffer is a solution of a weak acid and one of its salts.

AT 13. A strong acid and a weak base produce an acidic solution.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
a 14. salt hydrolysis	a. the cations or anions of a dissociated salt remove hydrogen ions from or donate hydrogen ions to water
d 15. buffer	b. the amount of acid or base that can be added to a buffer solution before a significant change in pH can occur
b 16. buffer capacity	c. the salt produced by the titration of ammonia with hydrochloric acid.
c 17. NH_4Cl	d. a solution in which the pH remains relatively constant when small amounts of acid or base are added

Part D Question

Answer the following in the space provided.

18. Predict whether an aqueous solution of each salt will be acidic, basic, or neutral.

a. NH_4Cl (NH_4OH + HCl) -> acidic

b. Na_2CO_3 ($NaOH$ + H_2CO_3) -> ~~neutral~~ basic

c. NH_4NO_3 (NH_4OH + HNO_3) -> acidic