

Acids and Bases

Before You Read

**Review
Vocabulary**

Define the following term.

chemical equilibrium

Chapter 9

Write *the equation for hydrogen chloride dissolving in water to form hydrogen ions and chloride ions.*

Explain *what type of compound hydrogen chloride is since it produces hydrogen ions in aqueous solution.*

Chapter 16

Identify *five factors that influence reaction rate.*

1. _____
2. _____
3. _____
4. _____
5. _____

Acids and Bases

Section 18.1 Introduction to Acids and Bases

Main Idea _____

Details _____

Skim Section 1 of your text. Write two questions that come to mind from reading the headings and the illustration captions.

1. _____

2. _____

New Vocabulary

Use your text to define each term.

acidic solution

basic solution

Arrhenius model

Brønsted-Lowry model

conjugate acid

conjugate base

conjugate acid-base pair

amphoteric

Lewis model

Section 18.1 Introduction to Acids and Bases (continued)

Main Idea

Properties of Acids and Bases*Use with pages 634–636.*

Details

Compare and contrast *the properties of an acid and a base by placing an X in the Acid column if the property applies to an acid and in the Base column if the property applies to a base.*

Acid	Properties	Base
	tastes sour	
	tastes bitter	
	feels slippery	
	affects color	
	reacts with metal	
	conducts electricity	
	has more hydrogen ions than hydroxide ions	
	has more hydroxide ions than hydrogen ions	

Write *the chemical equation for the self-ionization of water.*

The Arrhenius and Brønsted-Lowry Models*Use with pages 637–639.*

Analyze *why the Arrhenius model of acids and bases does NOT include ammonia (NH₃) in solution as a base.*

Identify *which of the following statements describes the Arrhenius model and which describes the Brønsted-Lowry model by filling in the blanks.*

The _____ model is based on the dissociation of compounds, while the _____ model is based on the donation and acceptance of hydrogen ions. Conjugate acid-base pairs are a component of the _____ model and are NOT a component of the _____ model.

Acids and Bases

Section 18.2 Strengths of Acids and Bases

Main Idea

Details

Skim Section 2 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Write three questions about strengths of acids and bases based on what you have read.

1. _____
2. _____
3. _____

New Vocabulary

Use your text to define each term.

strong acid

weak acid

acid ionization constant

strong base

weak base

base ionization constant

Section 18.2 Strengths of Acids and Bases (continued)

Main Idea

Details

Strengths of Acids*Use with pages 644–647.***Explain** *why all acids are not equal in strength.*

Identify *the acids in the following table as strong or weak.*

Acid	Strong or Weak	Acid	Strong or Weak
acetic		hydroiodic	
carbonic		hydrosulfuric	
		hypochlorous	
hydrochloric		nitric	
hydrofluoric		sulfuric	

Describe *the difference in conductivity between strong and weak acids.*

Analyze *equilibrium constant expressions by completing the following statements.*

The concentration of liquid water in the denominator of an equilibrium constant expression is considered to be _____ in dilute aqueous solutions. Therefore, liquid water can be _____ K_{eq} to give a new equilibrium constant, K_a . For weak acids, the equilibrium _____ of the _____ in the numerator tends to be small compared to the equilibrium _____ of the _____ in the denominator. The weakest acids have the _____ K_a values because their solutions have the highest concentrations of _____ acid molecules.

Section 18.2 Strengths of Acids and Bases (continued)

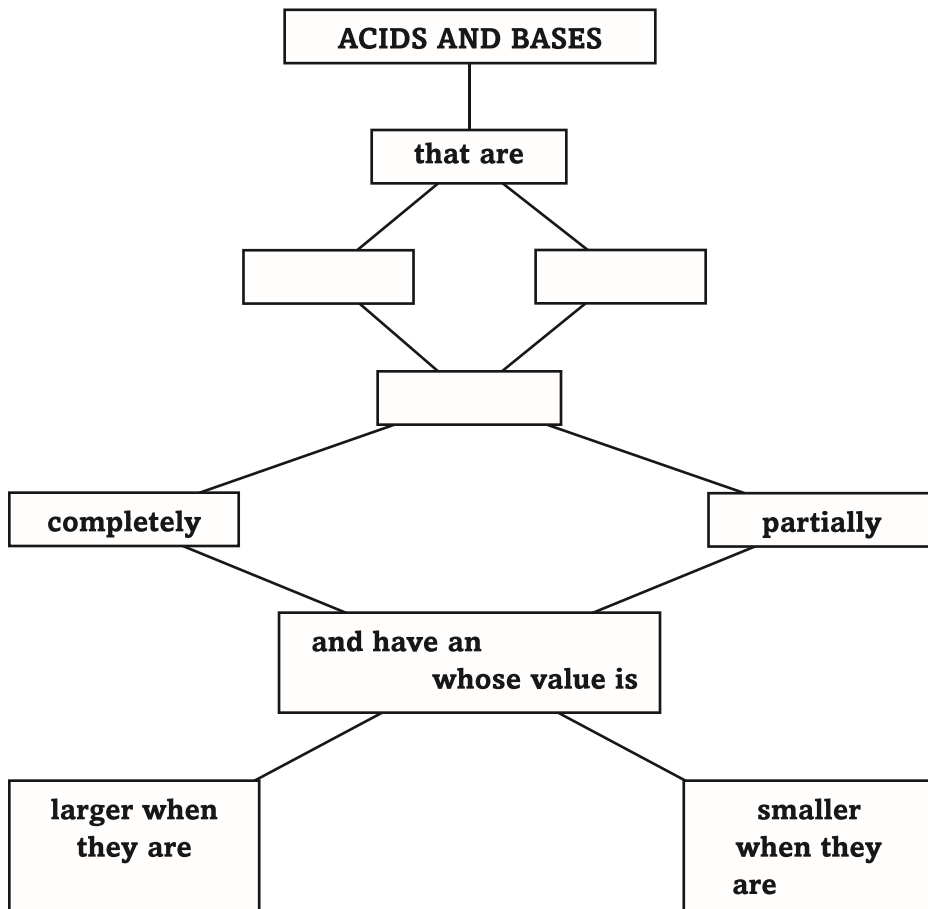
Main Idea

Details

Strengths of Bases

Use with pages 648 and 649.

Compare and contrast *the strengths of acids and bases by completing this concept map using the terms ionize, ionization constant, strong, stronger, weak, and weaker.*



Describe *the differences between the strength and the concentration of acids and bases by completing the following statements.*

The number of the acid or base molecules dissolved is described by the terms _____ and _____. The degree to which an acid or base separates into ions is described by the terms _____ and _____. A strong acid can be a _____ solution and a _____ acid can be a concentrated solution.

Acids and Bases

Section 18.3 Hydrogen Ions and pH

Main Idea

Details

Scan Section 3 of your text. Use the checklist below as a guide.

- Read all section titles.
- Read all boldfaced words.
- Read all formulas.
- Look at all figures and read the captions.
- Think about what you already know about alcohols, ethers, and amines.

Write three facts you discovered about pH as you scanned the section.

1. _____
2. _____
3. _____

New Vocabulary

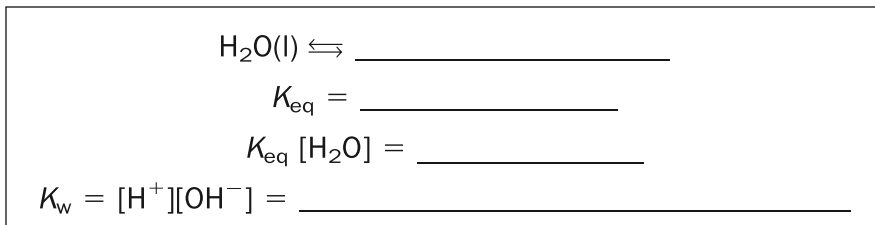
Use your text to define the following terms.

ion product constant for water

pH

pOH

Section 18.3 Hydrogen Ions and pH (continued)

Main Idea**Ion Product Constant for Water***Use with pages 650–651.***Calculate $[H^+]$ and $[OH^-]$ Using K_w** *Use with Example Problem 18.1, page 651.***Details****Describe** *how the ion product constant for water is derived from the self-ionization equation.***Summarize** *Fill in the blanks to help you take notes while you read Example Problem 18.1.***Problem**Calculate $[OH^-]$ using _____ and the concentration of _____, and determine if the solution is acidic, basic, or neutral.**Step 1: Analyze the Problem**

Known:

 $[H^+] = \underline{\hspace{2cm}}$ $K_w = \underline{\hspace{2cm}}$

Unknown:

 $[OH^-] = ? \text{ mol/L}$ Write what you can predict about $[OH^-]$:

Step 2: Solve for the Unknown

Write the ion product constant expression

 $K_w = \underline{\hspace{2cm}}$ Solve for $[OH^-]$ by _____. $[OH^-] = \underline{\hspace{2cm}}$ $[OH^-] = \underline{\hspace{2cm}}$ Since $[H^+] > [OH^-]$, _____.

Section 18.3 Hydrogen Ions and pH (continued)

Main Idea

Details

Step 3: Evaluate the Answer

The answer is correctly stated with ____ significant figures because $[H^+]$ and $[OH^-]$ each have two. The hydroxide ion concentration _____ the prediction.

pH and pOH

Use with pages 652–658.

Compare and contrast *pH* and *pOH* by completing the following table.

Solution Type	Scale Measure	Relationship (Equation)
acid	pH	
base		
acid and base		

Analyze the process of calculating *pH* and *pOH* from the hydroxide concentration.

Describe the process of calculating the hydrogen ion and hydroxide ion concentrations from *pH*.

Describe the process of calculating K_a from *pH* for a 0.100M weak acid.

Acids and Bases

Section 18.4 Neutralization

Main Idea

Details

Skim Section 4 of your text. Focus on the headings, subheadings, boldfaced words, and the main ideas. Write three questions about strengths of acids and bases based on what you have read.

1. _____
2. _____
3. _____

New Vocabulary

Define the following terms.

neutralization reaction

salt

titration

titrant

equivalence point

acid-base indicator

end point

salt hydrolysis

buffer

buffer capacity

Section 18.4 Neutralization (continued)

Main Idea

Reactions Between Acids and Bases

Use with pages 659–664.

Details

Write the full equation of the neutralization reaction for magnesium hydroxide and hydrochloric acid.

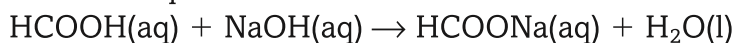
Draw the titration curve for 50.0 mL 0.100M HCl titrated with 0.100M NaOH. Label the pH and volume vectors, as well as the equivalence point.

Describe the indicator that matches each of the following pH levels. Use Figure 18.24 as a guide.

pH	Indicator
7.2	
4.2	
1.8	
1–12	

Explain the process for calculating the molarity of an unknown HCOOH solution by completing the equations below.

Balanced equation:



$$18.28 \text{ mL NaOH} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ L NaOH}$$

$$0.01828 \text{ L NaOH} \times \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} \text{ mol NaOH}$$

$$1.828 \times 10^{-3} \text{ mol NaOH} \times \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} \text{ mol HCOOH}$$

$$1.828 \times 10^{-3} \text{ mol HCOOH} / \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} \text{ M HCOOH}$$

Section 18.4 Neutralization (continued)

Main Idea

Details

Salt Hydrolysis

Use with page 665.

Describe *salt hydrolysis by completing the following statements.*

Some aqueous salt solutions are neutral, some are basic, and some are _____. The reason for this is a process known as _____. In this process, the anions of the dissociated salt donate _____ to water. Salts that will hydrolyze have a weak acid and a _____ or a strong acid and a _____. A salt formed from a strong acid and a weak base will form an _____. A salt formed from a strong base and a weak acid will form a _____. Salts formed from weak acids and bases or from strong acids and bases will not hydrolyze and form _____.

Buffered Solutions

Use with pages 666–667.

Explain *how a buffer works by completing the table below.*

The equation at equilibrium	$\text{HF(aq)} \rightleftharpoons \text{H}^+(\text{aq}) + \text{F}^-(\text{aq})$	
Δ Condition	Equilibrium Shift	The Process
add acid	left	The H^+ ions react with F^- ions to form
add base	right	The OH^- ions react with H^+ ions to form water. This decreases the concentration of the H^+ ions so that
A greater _____ of the buffering molecules and ions in the solution leads to a _____ of the solution.		
A buffer has _____ of an acid and its or a base with its _____		

Acids and Bases Chapter Wrap-Up

Now that you have read the chapter, review what you have learned; write out three key equations and relationships.

1. _____

2. _____

3. _____

Review

Use this checklist to help you study.

- Study your Science Notebook for this chapter.
- Study the definitions of vocabulary words.
- Review daily homework assignments.
- Reread the chapter and review the tables, graphs, and illustrations.
- Review the Section Assessment questions at the end of each section.
- Look over the Study Guide at the end of the chapter.

REAL-WORLD CONNECTION

Suppose you are on the bench for your school's soccer team when one of the players comes out of the game with a cramp. A teammate suggests that she start breathing into a paper bag to recover sooner. Explain whether or not this is good advice.
