Chapter 6 Summary

6.1 Identifying Acids and Bases

Key Concepts

- Acids are compounds that have a sour taste. When dissolved in water, they produce hydrogen ions, $H^+(aq)$.
- Binary acids are composed of hydrogen and a non-metal. The name of a binary acid is written using the prefix *hydro-*, the root of the non-metal name, and the ending *-ic acid*.
- Oxoacids that form between hydrogen and polyatomic ions are named by replacing *-ate* with *-ic acid* and *-ite* with *-ous acid*.
- Bases are compounds that have a bitter taste. Many bases are ionic compounds that separate into metal ions and hydroxide ions, $OH^-(aq)$, when they dissolve in water.
- Since many bases are ionic compounds, their names and formulas are written following the same rules that are used for ionic compounds.

6.2 The pH Scale and Indicators

Key Concepts

- The pH scale ranges from 0 to 14 and is used to classify an aqueous solution as acidic, basic, or neutral. Neutral solutions are pH 7. Acidic solutions have a pH less than 7. Basic solutions have a pH greater than 7.
- A change of 1 on the pH scale represents a change in the concentration of hydrogen ions in a solution by a factor of 10. The pH of a solution can be determined using pH indicators or an electronic pH probe.
- A pH indicator is a chemical that is added in small amounts to a solution to visually show the acidity or basicity of the solution by changing colours within a small range of pH values.
- Universal pH indicator and pH paper contain several indicators and can be used to determine the pH of a solution.

6.3 Reactions of Acids and Bases

Key Concepts

- A neutralization reaction occurs when an acid and a base react to form water and a salt.
- Acid precipitation forms from non-metal oxides, such as the oxides of sulfur and of nitrogen. These oxides in the atmosphere react with water to form acids. Scrubbers are used to remove sulfur dioxide from exhaust gases.
- Acid precipitation can have detrimental effects, particularly on rivers and lakes. Renewing a lake involves adding limestone to the water to help neutralize the acid and raise the pH.
- The properties of acids make them useful for extracting metals from ores, but the process may contaminate an area. These same properties also mean that acids are useful for leaching toxic metals from contaminated soils.

Chapter 6 Review

Make Your Own Summary

Summarize the key concepts of this chapter using a graphic organizer. The Chapter Summary on the previous page will help you identify the key concepts. Refer to Study Toolkit 4 on pages 565–566 to help you decide which graphic organizer to use.

Reviewing Key Terms

Match each key term listed below to its definition.

a. acid
b. pH indicator
c. pH scale
d. base
e. neutralization
f. oxoacid
g. binary acid

1. A compound that contains a hydroxide ion, OH^- (6.1)

2. A numerical scale that ranges from 0 to 14 and is used to classify aqueous solutions as acidic, basic, or neutral. (6.2)

3. A substance that produces hydrogen ions, $H^+(aq)$, when dissolved in water. (6.1)

4. An acid composed of hydrogen and a non-metal. (6.1)

5. A reaction of an acid and a base to produce a salt and water. (6.3)

6. A substance that changes colour to show the concentration of hydrogen ions (H^+) and hydroxide ions (OH^-) in a solution. (6.2)

7. An acid composed of hydrogen, oxygen, and another element. (6.1)

Knowledge and Understanding K/U

8. Identify each of the following compounds as an acid or a base. Then, write the name of each compound.

a. $HCl(aq)$
b. $Mg(OH)_2(aq)$
c. $H_3PO_4(aq)$
d. $LiOH(aq)$

9. Write the chemical formula for each of the following acids.

a. nitric acid
b. hydrobromic acid
c. sulfurous acid

10. How does the acidity of a solution change as its pH rises?

11. What do all indicators have in common?

12. What is the difference between universal indicator and litmus?

13. Why is it important to maintain water in a swimming pool at the correct pH?

14. What effect would each of the following changes likely have on acid precipitation in an area? Explain your reasoning.

a. removing catalytic converters from cars
b. removing sulfur from coal before burning the coal

15. Why should you never use taste to identify whether an unknown chemical is an acid or a base?

16. Write a balanced chemical equation for each of the following neutralization reactions.

a. hydrobromic acid + calcium hydroxide
b. lithium hydroxide + sulfurous acid
c. magnesium hydroxide + phosphoric acid

Thinking and Investigation T/I

17. Non-metal oxides are often called *acidic anhydrides*. Using a dictionary or other reference source, explain what this term means and why it is a correct description of these compounds.

18. The data in the table below were recorded during an investigation. Based on these data, what is the best estimate for the pH of the solution?

pH Indicator	Colour
Methyl orange	yellow
Bromothymol blue	blue
Phenolphthalein	pink

19. The data in the table were collected during an investigation of acids and bases. Decide whether each of the following solutions is acidic, basic, or neutral, based on the data collected.

Solution	Red Litmus Paper	Blue Litmus Paper
A	stays red	stays blue
B	turns blue	stays blue
C	stays red	turns red
D	turns blue	stays blue

20. The illustration below shows a step from an investigation in which a pH meter is being used to test a solution.

a. What type of solution is it? How can you tell?

b. Describe how red litmus paper and blue litmus paper would respond to this solution.

c. Should HCl(aq) or KOH(aq) be added to neutralize this solution? Explain your reasoning.

21. Why it is not correct to say that a solution is basic if it does not change the colour of blue litmus paper? What other result would be needed to support the conclusion that the solution is basic?

22. What kind of oxides form acids when they react with water? Give two examples to support your answer.

Communication C

23. Use a graphic organizer to prepare a summary sheet on the instructions for writing the chemical formula for an acid from its name, and for writing the name of an acid from its chemical formula.

24. BIG IDEAS Chemicals react with each other in predictable ways. Using a diagram, show how acids and bases typically react, and define this type of reaction.

25. BIG IDEAS Chemical reactions may have a negative effect on the environment, but they can also be used to address environmental challenges. Explain how acid leaching is both helpful and harmful. Describe its importance to and effect on technology, society, and the environment.

Application A

26. Which of these products turn blue litmus paper to red? Explain your reasoning.

27. Sulfuric acid is important in the manufacture of many different products. Use the Internet or other resource to determine at least 10 products or processes in which sulfuric acid plays a role. Display your findings using a graphic organizer.

28. Bacteria are used to make cheese (pH 5.5) and yogurt (pH 4.5) from milk (pH 6.5).

a. Which of these foods is most acidic?

b. How many times more acidic is the most acidic food compared with the least acidic food?

29. Research steps being taken by the government of Ontario to protect and renew the Great Lakes. What can you do to help?