

## Target Reading Skill

**Create Outlines** To help review Section 3, copy the incomplete outline for the section. Complete the outline by adding subtopics and details. Be sure to include Key Concepts and Key Terms.

### Describing Acids and Bases

- I. Properties of acids
  - A. Taste sour
  - B. React with metals
  - C.
  - D.
- II. Properties of bases

## Reviewing Key Terms

Choose the letter of the best answer.

- Sugar water is an example of a
  - suspension.
  - solution.
  - solute.
  - colloid.
- A solution in which more solute may be dissolved at a given temperature is a(n)
  - neutral solution.
  - unsaturated solution.
  - supersaturated solution.
  - saturated solution.
- A compound that changes color when it contacts an acid or a base is called a(n)
  - solute.
  - solvent.
  - indicator.
  - salt.
- A polyatomic ion made of hydrogen and oxygen is called a
  - hydroxide ion.
  - hydrogen ion.
  - salt.
  - base.
- Ammonia is an example of a(n)
  - acid.
  - salt.
  - base.
  - antacid.

Complete the following sentences so that your answers clearly explain the Key Terms.

- A **solution** is a mixture that contains \_\_\_\_\_.
- Pepper and water make a **suspension** because \_\_\_\_\_.
- An **acid** is a substance that tastes sour, reacts with metals and carbonates, and \_\_\_\_\_.
- Soap is an example of a **base** because \_\_\_\_\_.
- Litmus is an example of an **indicator** because \_\_\_\_\_.

## Writing in Science

**Product Label** Suppose you are a marketing executive for a maple syrup company. Write a description of the main ingredients of maple syrup that can be pasted on the syrup's container. Use what you've learned about concentration to explain how dilute tree sap becomes sweet, thick syrup.



**Video Assessment**  
Discovery Channel School  
Acids, Bases, and Solutions

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## Target Reading Skill

**Create Outlines** I. C. React with carbonates, D. Turn blue litmus paper red; II. A. Taste bitter, B. Feel slippery, C. Turn red litmus paper blue

## Reviewing Key Terms

- b
- b
- c
- a
- c
- solute particles (molecules or ions) that are too small to see
- the pepper particles can be seen and easily separated by settling or filtration
- turns blue litmus paper red
- soap tastes bitter, feels slippery, turns red litmus paper blue, and produces hydroxide ions in water
- it changes color when in contact with an acid or a base

## Writing in Science



**E-LA: Writing 8.2.0**

**Writing Mode** Descriptive

### Scoring Rubric

- Exceeds criteria; includes the correct list of ingredients and an accurate, detailed description
- Meets criteria
- Includes a list and description but contains some omissions and/or errors
- Includes a vague description only and/or contains serious errors

## Video Assessment

### Acids, Bases, and Solutions

Show the Video Assessment to review chapter content and as a prompt for the writing assignment. Discussion questions: **What substance in maple sap is concentrated to make maple syrup? (Sucrose) Why is heat necessary for the production of maple syrup? (Heating the sap causes water to evaporate, making the solution more concentrated. Heating also destroys bacteria in the syrup.)**

# Review and Assessment

## Checking Concepts

11. You could shine a flashlight through them. Light passes through a solution without scattering, but a colloid scatters the light.
12. A concentrated solution of sugar water contains more solute relative to the amount of solvent than a dilute solution. A concentrated solution also tastes sweeter and has a lower freezing point and higher boiling point.
13. Sample answer: Tomato juice would turn blue litmus paper red, and it would react with a base.
14. An indicator is a different color in an acid than it is in a base.
15. A strong acid might have a pH of 1, 2, or 3.
16. Hydrochloric acid (HCl) and sodium hydroxide (NaOH) combine to make the salt sodium chloride (NaCl).

## Thinking Critically

17. The solubility of a gas decreases with decreased pressure. As a scuba diver comes up from a dive, the pressure decreases and nitrogen becomes less soluble. If the diver comes up too fast, the nitrogen comes out of solution in the blood, forming gas bubbles and resulting in “the bends.”
18. The solubility of a gas is lower at higher temperatures. As the cold water warms to room temperature, the solubility of dissolved gases in the water decreases, causing some of the dissolved gases to come out of solution.
19. Based on the litmus paper changes, one liquid is an acid and the other is a base. When they react, they form a neutral solution of a salt in water. This reaction is called neutralization.
20. An acid forms hydrogen ions ( $H^+$ ) in a water solution. A base forms hydroxide ions ( $OH^-$ ) in a water solution.
21. KCl
22.  $Ca^{2+}$  and  $OH^-$

## Math Practice

23. 100 g
24. 50 mL

## Checking Concepts

11. Explain how you can tell the difference between a solution and a clear colloid.
12. Describe at least two differences between a dilute solution and a concentrated solution of sugar water.
13. Tomatoes are acidic. Predict two properties of tomato juice that you would be able to observe.
14. Explain how an indicator helps you distinguish between an acid and a base.
15. Give an example of a very acidic pH value.
16. What combination of acid and base can be used to make the salt sodium chloride?

## Thinking Critically

17. **Applying Concepts** A scuba diver can be endangered by “the bends.” Explain how the effects of pressure on the solubility of gases is related to this condition.
18. **Relating Cause and Effect** If you leave a glass of cold tap water on a table, sometime later you may see tiny bubbles of gas form in the water. Explain what causes these bubbles to appear.
19. **Drawing Conclusions** You have two clear liquids. One turns blue litmus paper red and one turns red litmus paper blue. If you mix them and retest with both litmus papers, no color changes occur. Describe the reaction that took place when the liquids were mixed.
20. **Comparing and Contrasting** Compare the types of particles formed in a water solution of an acid with those formed in a water solution of a base.
21. **Problem Solving** Fill in the missing salt product in the reaction below.
$$HCl + KOH \rightarrow H_2O + ?$$
22. **Predicting** What ions are formed when the base CaO is dissolved in water?

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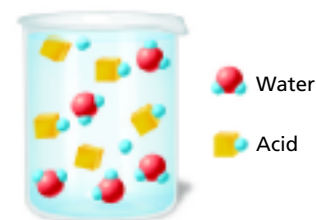
## Math Practice

23. **Calculating a Concentration** If you have 1,000 grams of a 10-percent solution of sugar water, how much sugar is dissolved in the solution?
24. **Calculating a Concentration** The concentration of an alcohol and water solution is 25 percent alcohol by volume. What is the volume of alcohol in 200 mL of the solution?

## Applying Skills

Use the diagram to answer Questions 25–28.

The diagram below shows the particles of an unknown acid in a water solution.



25. **Interpreting Diagrams** How can you tell that the solution contains a weak acid?
26. **Inferring** Which shapes in the diagram represent ions?
27. **Making Models** Suppose another unknown acid is a strong acid. Make a diagram to show the particles of this acid dissolved in water.
28. **Drawing Conclusions** Explain how the pH of a strong acid compares with the pH of a weak acid of the same concentration.



## Standards Investigation

**Performance Assessment** Demonstrate the indicators you prepared. For each indicator, list the substances you tested in order from most acidic to least acidic. Would you use the same materials if you did this investigation again? Explain.

## Applying Skills

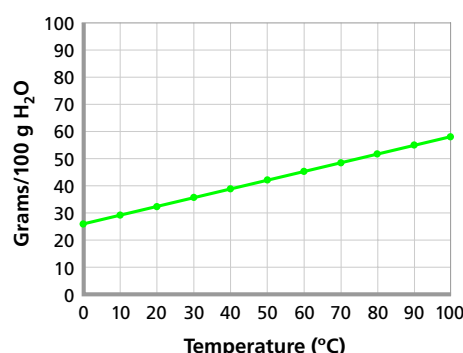
25. You can tell that the solution contains a weak acid because very few acid particles have broken up into hydrogen ions and negative ions.
26. The unpaired yellow cubes and the unpaired blue circles represent ions.
27. Students' diagrams should show that most or all the hydrogen ions and negative ions have separated from each other.
28. The higher the hydrogen ion concentration, the lower the pH. A strong acid produces more hydrogen ions in solution than a weak acid does, so a strong acid has a lower pH than a weak acid of the same concentration.

Choose the letter of the best answer.

1. A scientist observes that an unknown solution turns blue litmus paper red and reacts with zinc to produce hydrogen gas. The unknown solution is most likely  
A a colloid.  
B an acid.  
C a base.  
D a suspension. **S 8.5.e**
2. Which of the following pH values indicates a solution with the highest concentration of hydrogen ions?  
A pH = 1  
B pH = 2  
C pH = 7  
D pH = 14 **S 8.5.e**
3. A base is defined as strong if it has a pH value in the range of  
A 0-3.  
B 4-7.  
C 8-11.  
D 12-14. **S 8.5.e**
4. Dissolving salt in water is an example of a physical change because  
A neither of the substances changes into a new substance.  
B the salt cannot be separated from the water.  
C the water cannot become saturated with salt.  
D a physical change occurs whenever a substance is mixed with water. **S 8.5.d**
5. Which of the following things could be used to determine whether a substance is an acid or a base?  
A pH paper  
B litmus paper  
C pH meter  
D all of the above **S 8.5.e**

Use the graph below and your knowledge of science to answer Question 6.

**Solubility of Potassium Chloride (KCl)**



6. A student makes a saturated solution of KCl and 100 g of water at 20°C. If the student leaves the solution and all of the water evaporates, how many grams of KCl will be left in the container?  
A 0 g  
B 16 g  
C 32 g  
D 40 g **S 8.5.d**
7. Which of the following is an example of a base?  
A tomatoes  
B lemons  
C vitamin C  
D soap **S 8.5.e**

## Apply the BIG Idea

8. You have an unknown solution. You want to know whether the solution is an acid or a base. First list some of the known properties of acids and bases. Then describe a method of determining whether the solution is an acid or a base. **S 8.5.e**

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Teachers can monitor student progress and supply remediation when necessary.

## Standards Practice

1. B; **S 8.5.e**
2. A; **S 8.5.e**
3. D; **S 8.5.e**
4. A; **S 8.5.d**
5. D; **S 8.5.e**
6. C; **S 8.5.d**
7. D; **S 8.5.e**

## Apply the BIG Idea

8. Acids taste sour, react with metals and carbonates, turn blue litmus paper red; Bases taste bitter, feel slippery, turn red litmus paper blue. You could dissolve the solution in water. If it produces hydrogen ions ( $H^+$ ), it is an acid. If it produces hydroxide ions ( $OH^-$ ), it is a base. **S 8.5.e**

## Lab zone Standards Investigation

**S 8.5.e**

**Performance Assessment** In their presentations, students should identify the acid-base indicators they made and the substances they tested. They should also present and interpret their summarized test

results. Suggest that students compare their results with the results of their classmates. They can try to determine which acid-base indicators produced results in closest agreement with pH test paper results.

## Teaching Resources

### Laboratory Manual TE

- Standards Investigation Scoring Rubric

The Standards Investigation Scoring Rubric will help you evaluate students' work. If you share the rubric in advance, students will know what is expected of them.