CHAPTER 3

Mixtures and

Getting Ready...

- What is a mechanical mixture?
- What is a solution?
- What are some examples of solutions?
- How can you separate mechanical mixtures and solutions?

Science Log

List every mixture you use between getting up in the morning and going to sleep at night. Classify each mixture as either a solution or a mechanical mixture. As you read the chapter, you will find out whether you have classified them correctly.

The TV news often features flood scenes such as the one shown here. What they do not show is people getting sick because of the water contamination the flood causes.

In fact, there are many types of water. If you had to classify the types, you might choose categories such as safe, clear, and dirty.

- Safe water is water you can drink without getting sick.
- Clear water looks safe but may contain contaminants that make you sick.
- Dirty water contains silt, sewage, and other debris.

Dirty water can be turned into clear water by letting the solid particles settle to the bottom or by filtering it. This clear water then needs to be treated in order to make it safe to drink. Depending on the treatment, it may not taste very good.

Dirty water is a mechanical mixture. Clear water is a solution of water and other substances. Even safe water is a solution of water and minerals. In this chapter, you will learn more about mechanical mixtures and solutions. Later in the chapter, you will learn how to separate mechanical mixtures using a filter. You will also learn how to separate solutions.

Their Uses

What You Will Learn

In this chapter you will learn:

- the differences between solutions and mechanical mixtures
- how to separate solutions and mechanical mixtures
- why some substances are soluble and others are not
- how to identify the solute and solvent in a solution
- how to communicate the concentration of a solution
- how temperature affects solubility

Why It Is Important

- Every year, countless people get sick or die from drinking contaminated water. Knowledge of mechanical mixtures and solutions helps us make dirty water safe to drink. This knowledge also helps us clean up waste water to reduce pollution.

Skills You Will Use

In this chapter you will:

- construct a filter to make water clear
- separate mixtures
- express the concentration of a solution
- differentiate between mechanical mixtures and solutions
- identify the effect of temperature on solubility

Starting Point ACTIVITY

Separating a Mechanical Mixture

Use your knowledge of the properties of substances to separate a mechanical mixture.

Safety Precautions

What You Need

2 beakers (250 mL)
funnel
magnet
stirring rod
mixture of sand, sugar, and iron filings (a mechanical mixture)
filter paper
water
sheet of newspaper

What to Do

1. Half fill a 250 mL beaker with the mixture.
2. Pour the mixture onto the newspaper.
3. Move the magnet over the surface of the mixture several times. Record your observations.
4. Pour the mixture back into the beaker.
5. Add 100 mL of water to the beaker and stir until you can not see any sugar crystals.
6. Filter the mixture from Step 5.
7. Examine the contents of the filter and beaker. Record your observations.
8. Wipe up any spills and wash your hands thoroughly.

3.1 Two Kinds of Mixtures

In Chapter 1, you began organizing all matter into a flowchart. The first branch represented the difference between pure substances and mixtures. You learned that pure substances (such as water or sugar) have only one type of particle. Mixtures (such as sugar water) are made up of more than one type of particle.

READING Check

Write a definition of the term "mixture."

In Chapter 2, you examined the left-hand branch of the flowchart. You learned that pure substances can be either elements or compounds.

In this chapter, you will take a closer look at mixtures. Figure 3.1 shows that mixtures can be classified into two broad categories: mechanical mixtures and solutions. Figure 3.2 shows the main difference between these two categories.

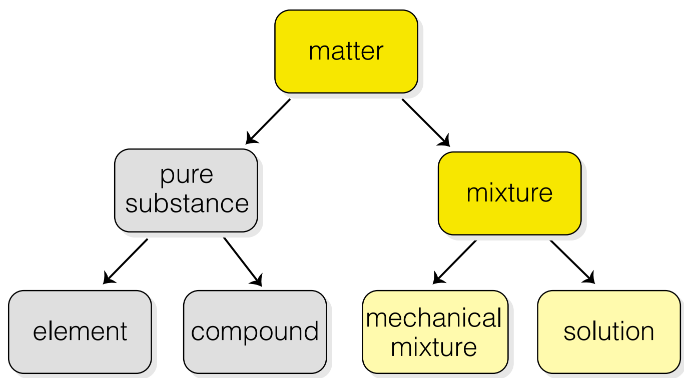


Figure 3.1 Mechanical mixtures and solutions represent another branch in the matter flowchart.

Mechanical Mixtures

If there appears to be more than one type of particle, then you know for sure that you are looking at a **mechanical mixture**. You can see the different substances in mechanical mixtures. Orange juice with pulp is one example.

Wet concrete is a mechanical mixture made from cement, water, sand, and gravel. Can you think of other mechanical mixtures around your home? Your kitchen likely has quite a few.

Figure 3.2 You can see different types of particles in this glass of orange juice. It is a mechanical mixture.

Solutions

Apple juice, iced tea, and window cleaner are all solutions. A **solution** is made when two or more substances combine to form a mixture that is uniform or looks the same throughout. In other words, a solution appears to contain only one kind of particle.

Shampoo, soda pop, dishwashing detergent, syrup, and vinegar are other examples of solutions. Before modern detergents, people added soap flakes to dish-water and waited for the flakes to dissolve. This solution of soap flakes and water was used to wash dishes.

Today, most people buy solutions ready-made because they are more convenient. It is much easier to use liquid dishwashing detergent than soap flakes.

Figure 3.3 Mechanical mixtures and solutions are both made up of different kinds of particles. In a solution, you cannot see the different types of particles. In a mechanical mixture, you can. Which of the mixtures shown here is a mechanical mixture? Which is a solution?

Parts of Solutions

Solutions consist of a solute and a solvent.

- The **solute** is the substance that dissolves.
- The **solvent** is the substance in which the solute dissolves.

There is usually less solute than solvent in a solution.

In salt water, salt is the solute and water is the solvent. If you read the labels on many of the food products you have around the house, you will notice that water is the solvent for many different solutes.

How can you tell if a mixture is a solution or a mechanical mixture?

- In a solution, you should only be able to see one substance.
- A second test is to pour the solution through a filter. If anything is caught in the filter, then the mixture is mechanical.

In the Find Out Activity on the next page, you will examine several household mixtures to determine whether they are solutions or mechanical mixtures.

READING Check

List five household substances that are more convenient to buy as a solution.

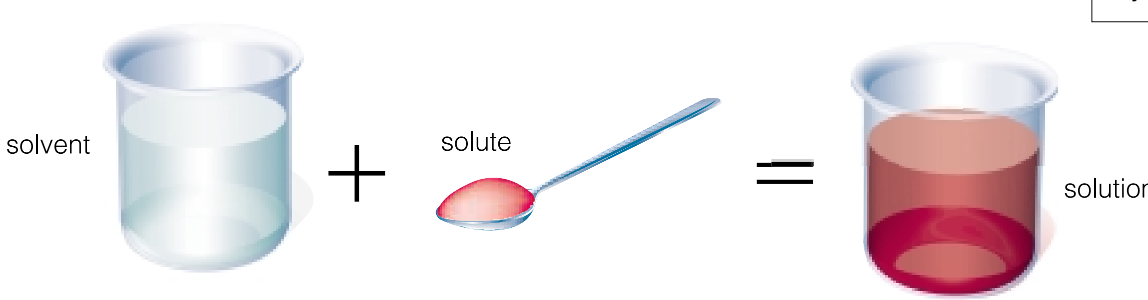


Figure 3.4 The solute is the substance that dissolves. The solvent does the dissolving. A solute and solvent combine to form a solution.

Find Out **ACTIVITY**

What Kind of Mixture?

In this activity, you will determine whether some common mixtures are solutions or mechanical mixtures by pouring them through a filter.

SKILLCHECK
- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Safety Precautions

What You Need

4 mixtures

filter paper

funnel

What to Do

1. Copy the following table into your Science Log or notebook and use it to record your observations.

Mixture	Prediction (Mechanical Mixture/ Solution)	Observations Before Filtering	Observations After Filtering	
			In Filter	In Beaker

2. In the first column, write the names of the four household mixtures.
3. Examine each mixture, and predict whether it is a solution or mechanical mixture. Write your predictions in column 2.
4. Pour each of the mixtures through a filter.
5. Examine the substance that went through the filter. Was anything left in the filter? Record your observations in the appropriate columns.
6. Wipe up any spills and wash your hands thoroughly.

What Did You Find Out?

1. Which of your observations matched your predictions?
2. How can you tell if a mixture is a solution or a mechanical mixture?

Key Terms

mechanical mixture

solution

solute

solvent

Check Your Understanding

1. Classify each of the following as a mechanical mixture or a solution.
   (a) concrete
   (b) shampoo
   (c) air
   (d) tap water
   (e) cookie dough
2. Describe two tests you can use to determine if a mixture is a solution or a mechanical mixture.
3. In each of the following solutions, identify the solute and solvent(s).
   (a) salt water
   (b) baking soda and water
   (c) air (78% nitrogen, 22% oxygen and other gases)
   (d) gold jewellery (90% gold, 10% silver)

3.2 What Are Solubility and Concentration?

Concentration describes the amount of solute in a solution. Manufacturers include the concentration of the solution on the label of many products. That way, people know how to use the product safely and effectively.

READING Check

Write a definition of "concentration."

Concentration is shown in many ways. One of the most common is in g/L. This unit expresses the mass of solute in 1 L of the solution. For example, Roundup™ is a herbicide (a plant-killing chemical). It is used to kill weeds before a crop is planted.

Roundup™ is a solution of glyphosate and water. The label says this product contains 7.0 g/L of glyphosate. This means that there are 7.0 g of glyphosate in 1 L of the product.

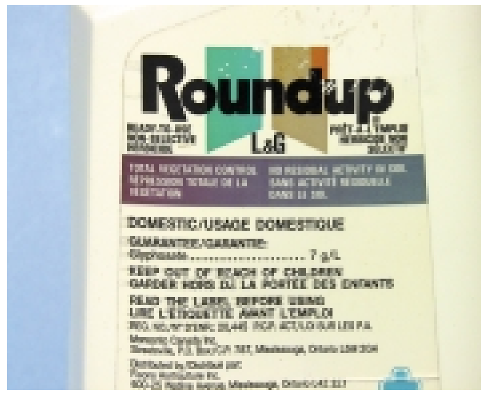


Figure 3.5 The active ingredient in this herbicide is glyphosate. According to the label, what is the concentration of glyphosate? What other information does the label contain? Why?

Find Out ACTIVITY

SKILL CHECK
- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Concentrations of Consumer Products

Whether they are foods, cleaning products, or fluids in our vehicles, solutions are an important part of our daily lives. In this activity, you will examine the properties of a variety of consumer products.

What to Do

1. List five products that show their concentration on the label.
2. Draw a table with the headings: Commercial Name, Solute, Solvent, and Concentration.
3. Complete the table by filling in the information from the product's label.

What Did You Find Out?

1. In the products you listed, what is the most common solvent?
2. What kinds of products tend to list concentration?
3. For each product you listed, why do you think the manufacturer provided concentration information on the label?

Solubility

Solubility describes how easily a solute will dissolve in a solvent to make a solution.

When a substance will dissolve in a solvent, we say that it is **soluble**. If a substance will not dissolve, it is said to be **insoluble**.

As you can see from the photographs in Figure 3.6, substances such as oil and gasoline do not dissolve in water. They are insoluble in water.

Rocks have very low solubility in water. In fact, the solubility of rock is so low that only very sensitive tools can detect it dissolving. Sugar, on the other hand, is very soluble in water. You can see sugar dissolve almost instantly.

Hummingbirds like sugar water with a concentration of 300 g/L. When you mix this solution, a lot of sugar tends to remain undissolved at the bottom of the container. How can you increase the solubility? Complete the next investigation to find out.

READING Check

Explain the difference between soluble and insoluble.

Try This!

Fill a glass three quarters full with water. Fill the glass to the top with vegetable oil. Wait for the oil to form a separate layer on the top, then add a few drops of food colouring. Is oil soluble in water? Is food colouring soluble in water or oil?

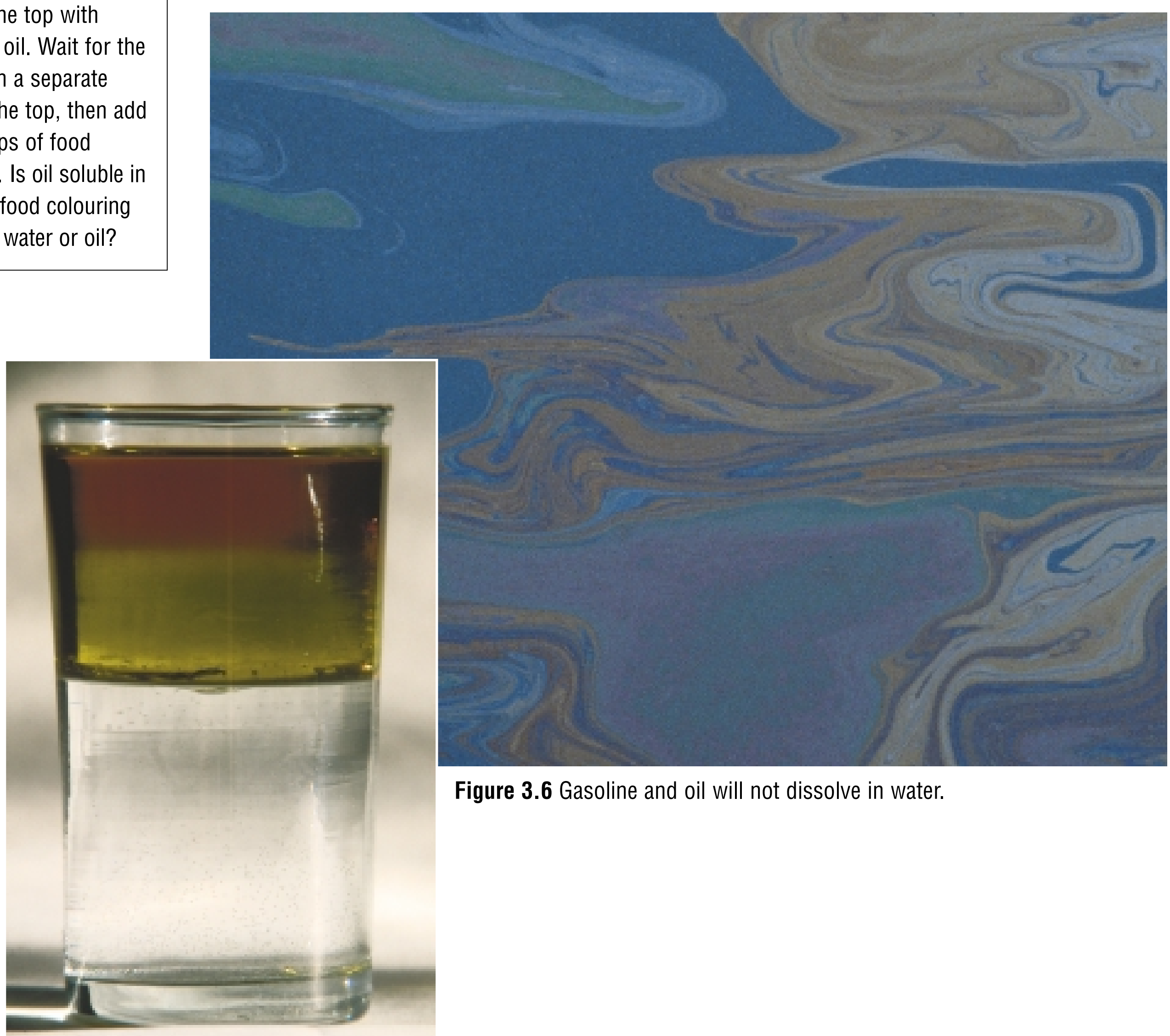


Figure 3.6 Gasoline and oil will not dissolve in water.

THINK & LINK

INVESTIGATION 3-A

SKILLCHECK
- Initiating and Planning
- ☼ Performing and Recording
- ☼ Analyzing and Interpreting
- Communication and Teamwork

How Does Temperature Affect Solubility?

Think About It

Turn to page 10 in Chapter 1 and reread the particle theory. What happens to the particles of a substance as it is heated? Do you think heating a solution will increase the amount of solute that will dissolve?

The data table here tells you how much of three substances will dissolve in water at various temperatures. In this investigation, you will examine the data and develop a theory about how temperature affects solubility.

What to Do

1. Prepare a graph outline for the data provided. Label the *x*-axis Temperature (°C) and the *y*-axis Solubility (g/L). Make the scale for the *x*-axis go from 0 to 100.

Temp (°C)	Solubility in Water (g/L)		
	sodium chloride ($NaCl_{(s)}$)	potassium chlorate ($KClO_{3(s)}$)	ammonium chloride ($NH_4Cl_{(s)}$)
10	370	50	320
20	373	70	370
30	378	110	410
40	380	150	460
50	382	210	500
60	387	270	550
70	390	340	600

2. Give your graph a descriptive title.

3. Using a different colour for each solute, plot the data points given in the table. Include a legend that shows the meaning of each colour.

For each set of data points, draw a line of best fit.

5. Use a dashed line to extend the lines on your graph so they cross the 100°C mark.

Analyze

1. Are the graphed lines straight or curved?
2. Examine the lines on the graph. As temperature increases, what happens to the lines?
3. Examine the extended line to predict the solubility of each solute at 95°C.
4. Which solute has the highest solubility at each of the following temperatures?
   (a) 20°C
   (b) 60°C
   (c) 95°C

Conclude and Apply

5. What happens to the solubility of a solute as the temperature of a solution increases?

Computer CONNECT

Use spreadsheet software to create a graph of the data.

CONDUCT AN

INVESTIGATION 3-B

SKILLCHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

What Is the Best Solvent?

Water is described as the universal solvent because thousands of substances will dissolve in it. Some substances, however, will not dissolve in water. Petroleum jelly is one of these. Complete this investigation to find out how to dissolve petroleum jelly.

Problem

Which is the best solvent to dissolve petroleum jelly and salt?

Prediction

Predict whether petroleum jelly and salt will dissolve more readily in water or in vegetable oil.

Safety Precautions

- Handle hot equipment with care.
- Unplug the hot plate at the end of the investigation, and let it cool before putting it away.

Apparatus

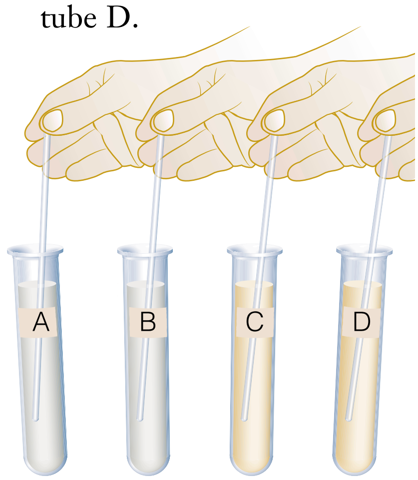
100 mL beaker
4 test tubes
test tube rack
25 mL graduated cylinder
hot plate
scale
2 scoopulas
4 stirring rods
tongs

Materials

masking tape
petroleum jelly
2 g salt
50 mL vegetable oil
50 mL water

Procedure

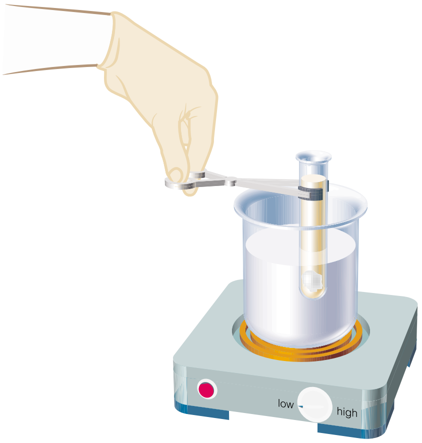
1. Using masking tape, label the test tubes A, B, C, and D.
2. Pour 15 mL of water into test tube A and test tube B.
3. Pour 15 mL of vegetable oil into test tube C and test tube D.



- Use a scoopula to add a small amount of petroleum jelly (about the size of the nail of your little finger) to test tube A and test tube C.

5. Add 0.5 g of salt to test tube B and test tube D.

- Stir the contents of each test tube. If the solutes do not dissolve, use the hot plate to heat the contents. To do this, place the test tube into a beaker of water that is being warmed on the hot plate. Use tongs to handle the warmed test tube.



7. Observe the contents of each of the four test tubes. Look for evidence of dissolving. Record your observations.

- Wipe up any spills and wash your hands thoroughly.

Analyze

1. **(a)** Did the salt dissolve in water?
   (b) Did it dissolve in vegetable oil?
2. **(a)** Did the petroleum jelly dissolve in water?
   (b) Did it dissolve in vegetable oil?
3. Did the petroleum jelly dissolve after it was heated?

Conclude and Apply

4. Use the particle theory to explain why heating helps a solute dissolve.
5. Why did petroleum jelly dissolve in one solvent but not in the other?

How Soap Works

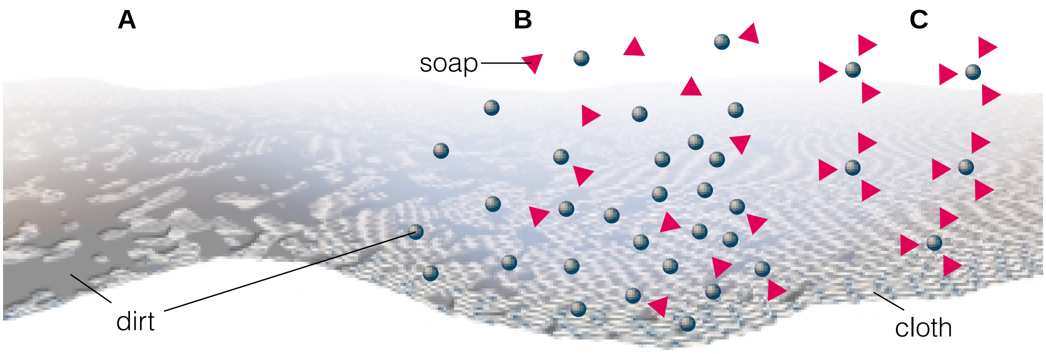
While you are eating a hamburger, a glob of grease and mustard lands on your pants. How can you get the stain out?

For centuries, people have used soap for such tasks. Soap was originally made from animal fat mixed with ashes from burned wood. When mixed together, these two substances form a new substance that can dissolve oils, dirt, and other substances. Although today's soaps are manufactured from purified chemicals, they work the same way.

Soaps dissolve in water to form a cleaning solution. While grease and mustard are not soluble in water, they are soluble in a soap solution. The soap solution dissolves grease and other stains, so they can then be rinsed away with the wash water.

READING Check

Think back to Think & Link Investigation 3–A: How Does Temperature Affect Solubility? How can temperature be used to further increase the cleaning power of laundry detergent?



A The clothes are agitated to loosen the dirt.

B A soap solution dissolves the loosened dirt and any dirt that is still on the fabric.

C The dirt and soap solution are then washed away.

Figure 3.7 In a washing machine, the agitation and soap solution work together to get clothes clean.

Key Terms

concentration
solubility
soluble
insoluble

Check Your Understanding

1. What does concentration tell you about a substance?
2. Explain the meaning of 12 g/L.
3. List some substances that are insoluble in water.
4. Describe how you could make a solute more soluble.
5. Define "solubility."

3.3 Separating Mixtures

Reading Check

Water that is unsafe to drink can be either a mechanical mixture or a solution. What might be mixed in it to make a mechanical mixture? What might be dissolved in it to make a solution?

At the beginning of the chapter, you learned about the importance of having safe water to drink. People can die from drinking unsafe water even if it looks clean and clear.

Floods and industrial pollution are not the only sources of contamination. In the fall of 2000, many people in Walkerton, Ontario got sick from drinking the town's tap water. Several people died. The problem was that run-off from nearby farms had contaminated the town's water with deadly *E. coli* bacteria.

Usually, Canadian tap water is safe to drink because it has been treated.

- Dirty water (mechanical mixture) is separated to produce water that is clear.
- Chemicals such as chlorine are added. These kill harmful bacteria.
- Other substances are added to remove dissolved chemicals (solution).

Did You Know?

Gold miners use their knowledge of the physical properties of gold when they "pan for gold." During panning, miners place a small amount of sand and gravel that may contain gold in the bottom of a shallow pan that looks a little like a pie plate. They slosh water in and out of the pan. As they do, the lighter particles of sand and silt are washed away in the water. The heavier gold flakes remain at the bottom of the pan.

Off the Wall

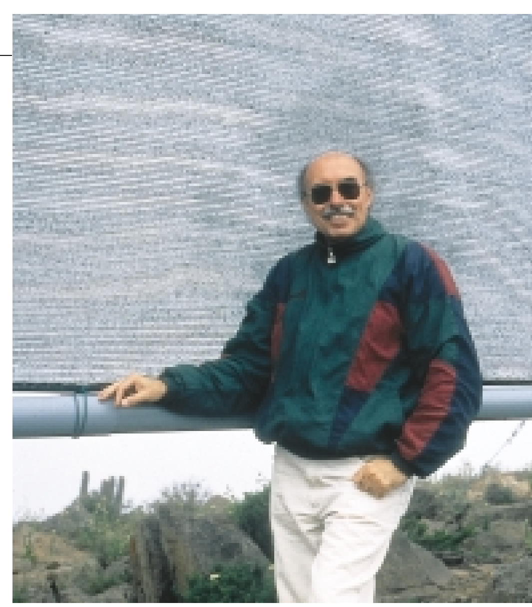


Figure 3.8 Did you know it is possible to catch water with a net? Dr. Bob Schemenaur, a Canadian scientist, helps people who live in dry or desert communities to get water from fog. To catch the water, Bob and his assistants put up nets that look a bit like volleyball nets. Wind blows the fog against the nets. Tiny water droplets catch on the fine plastic mesh and trickle down. The water is then used for drinking, cooking, and bathing.

DESIGN & DO

INVESTIGATION 3-C

SKILL CHECK

Initiating and Planning

- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Making Dirty Water Clear

Challenge

Imagine that you run out of drinking water on a camping trip. There is a beaver pond close by. You can see bugs and weeds floating in the water and can smell the mud and rotting leaves. Drinking this water will definitely make you sick. Your challenge in this investigation is to make 500 mL of this water clear. This is the first step in making the water safe to drink.

Safety Precautions

- Wash your hands thoroughly after working with dirty water.

Apparatus

2 L pop bottle with bottom cut off
ring clamp
ring stand
stopwatch

Materials

sand
gravel
cotton cloth
500 mL dirty water

Design Criteria

A. Design a filter that will clarify 500 mL of dirty water.

B. Use only the materials provided.

C. This activity must be completed in one class period.

Plan and Construct

1. With a partner, discuss what materials you will use.

2. Draw a diagram of your filter.

3. After you have received your teacher's approval, proceed with the investigation.

Build your filter out of the materials provided. Once you have made your filter, test it using 500 mL of the dirty water. Use a stopwatch to time how long it takes to filter the water.

Evaluate

1. Did clear water come out of the bottom of your filter? How can you tell?
2. How could you redesign the filter so it would work faster and produce clearer water?
3. What could you do to prevent your filter from clogging?

Separating Solutions

Now that you know how to make dirty water clear, how can you remove dissolved materials from it? This is important because some water contains dissolved impurities. In the next investigation, you will remove salt from water. You could use the same method to remove dissolved chemicals.

CONDUCT AN

INVESTIGATION 3-D

SKILLCHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Get Salt from Salt Water

Great Salt Lake in the United States is so salty that it is a tourist attraction. Entrepreneurs once sold salt taken from the lake. At first, dried salt was found on the shore and hauled away. The problem with that method, however, was how to get rid of the mud gathered with the salt. Water was added to the muddy salt and the mixture was filtered. The salt water flowed through the filter leaving the mud behind. The salt water was then heated to evaporate the water, leaving the salt crystals behind. This method is referred to as **crystallization**. In this investigation, you will use crystallization to separate the salt from a salt-water solution.

Problem

How can you separate all the salt from 50 mL of salt water?

Prediction

Predict whether heating a salt-water solution will separate the salt from the mixture.

Safety Precautions

- Use oven mitts or tongs to handle hot glassware.
- Wear a visor when near the evaporating dish as it is heating.
- Unplug the hot plate at the end of the investigation, and let it cool before putting it away.

Apparatus

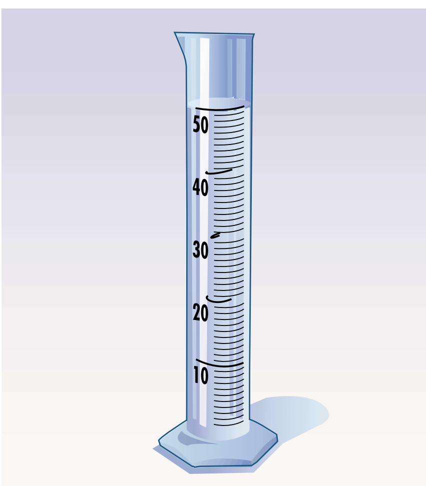
evaporating dish
50 mL graduated cylinder
hot pad
hot plate
stirring rod
tongs
watch glass

Materials

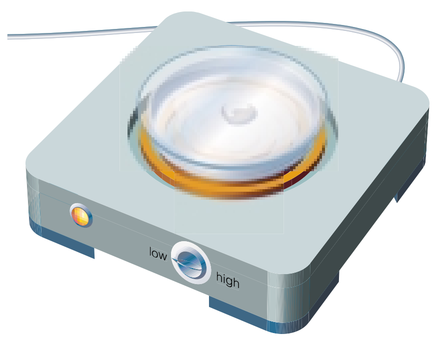
50 mL salt water

Procedure

1. Pour 50 mL of salt water into the empty evaporating dish. Cover the evaporating dish with the watch glass.



2. Put the evaporating dish onto the hot plate and gently heat the solution. As the solution heats, record your observations.



3. When all of the water has evaporated, remove the evaporating dish from the hot plate and set it on the hot pad to cool.

Once the evaporating dish has cooled, remove the watch glass and examine the residue. Record your observations.

5. Clean the evaporating dish and watch glass with tap water.

Clean up any spills and wash your hands thoroughly.

Analyze

1. Describe the appearance of the solution in Step 1.
2. Describe the residue that remained in the evaporating dish.

Conclude and Apply

3. What happened to the water in the solution?
4. What substance remained in the evaporating dish?

Extend Your Skills

5. What method could you use to collect the water that evaporated?

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

In many disasters, more people die from contaminated water than from the disaster itself. Is there a way to use the energy from the Sun to purify water in an emergency? For information on solar water purification, go to the above web site. Go to Internet Connects, Unit A, Chapter 3, and then to Using the Sun to Make Water Safe to Drink.

Purifying Water

In Design & Do Investigation 3–C and Conduct an Investigation 3–D, you experimented with two techniques for making water drinkable. Water treatment plants use similar methods to make sure that the water you get is safe to drink.

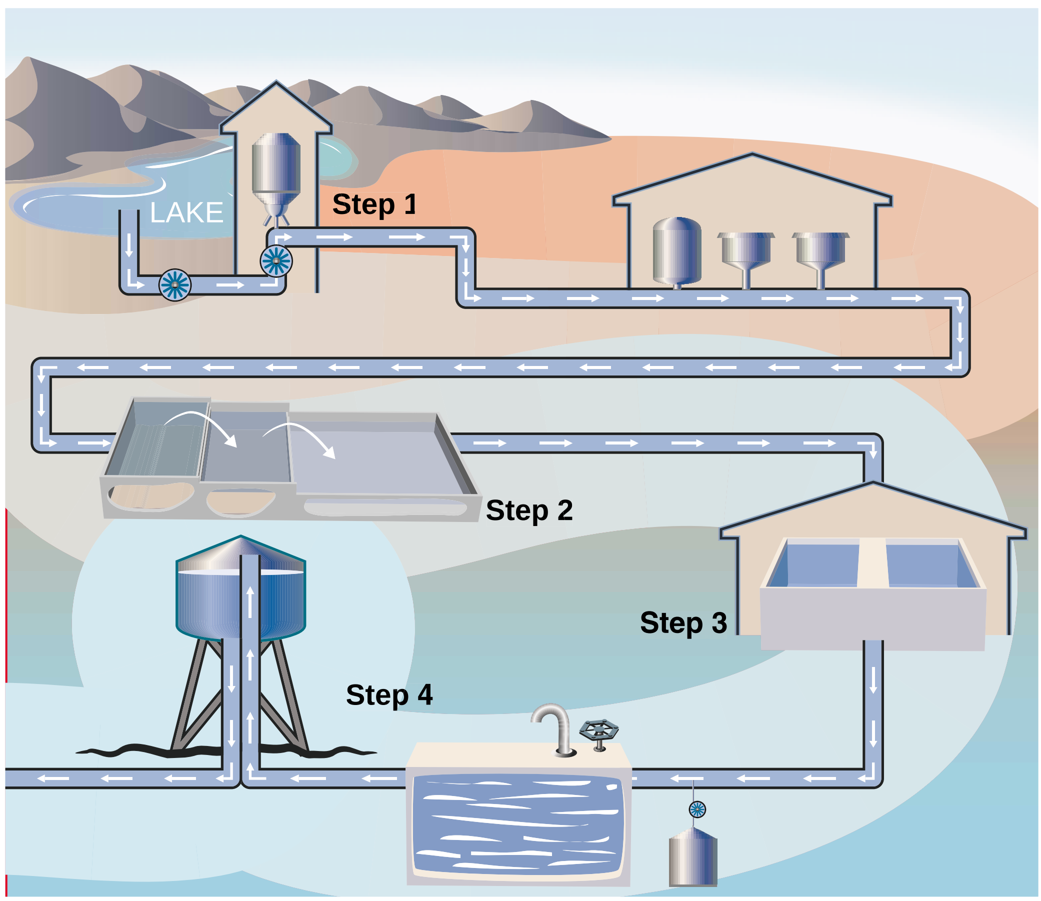
In one method, technicians add alum to impure water. Bacteria, viruses, and tiny dirt particles stick to the alum particles making them very heavy. These heavy particles sink to the bottom, where they can be separated from the water.

Another step uses charcoal filters to remove dissolved impurities. The water that leaves the filter is still not clean and safe to drink.

Water treatment plants also add chlorine to drinking water. The chlorine kills any bacteria that are still present.

READING Check

List the four steps in water treatment.



Step 1
Alum surrounds dirt particles in the same way that soap surrounds dirt particles in the laundry. The dirt particles get heavy.

Step 2
The heavy particles sink to the bottom. Clearer water is poured off the top.

Step 3
Filters remove any remaining solid particles.

Step 4
Chemicals such as chlorine kill any remaining bacteria.

Figure 3.9 Water treatment

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

How is water purified in urban water control plants? What processes are used? To find out, go to the above website. Go to Internet Connects, Unit A, Chapter 3, and then to Purifying City Drinking Water.

Distillation

Distillation is another way to get clean water. During this process, water is boiled and the steam collected. As the steam cools, it condenses to form pure water. Anything that was dissolved in the water is left behind. This includes solid particles such as salts and minerals, as well as other impurities such as bacteria and viruses.

READING Check

What is the advantage of distilling water?

Career CONNECT

Painters use their knowledge of solutions and solubility whether they are working on a canvas, wall, or building. Painters routinely mix solute and solvent to get the right colour and consistency in paint, varnish, and other finishes. They also use a variety of solvents to dissolve old finishes and help clean up.

To become a qualified painter, you need a high school diploma and on-the-job training. With a high school diploma, you can find an employer who is willing to hire and train an apprentice. Once hired, you can enter the Painter and Decorator Apprenticeship Program. The apprenticeship lasts three years and includes a total of 24 weeks of classroom learning.

Figure 3.10

Check Your Understanding

1. Describe how each of the following items could be used to separate a mechanical mixture.
   (a) filter paper
   (b) magnet
   (c) water or turpentine
   (d) strainer
   (e) window screen
2. Explain how crystallization could be used to separate drink crystals from juice.
3. List the steps in making water safe to drink.
4. Define "distillation."

Key Terms

crystallization
distillation

CHAPTER

3 Review

Key Terms

mechanical mixture
solution
solute
solvent
concentration
solubility
soluble
insoluble
crystallization
distillation

Reviewing Key Terms

If you need to review, the section numbers show where these terms were introduced.

1. Describe the difference between:
(a) solute and solvent (3.1)
(b) mechanical mixture and solution (3.1)
(c) filtration and crystallization (3.3)

2. In your notebook, write the correct term or terms to complete the following sentences:
(a) A mixture that appears to contain only one kind of particle is called a ____________________ . (3.1)
(b) The mass of solute per volume of solution is referred to as the substance's ____________________ . (3.2)
(c) If the label on a container reads 5 g/L, it means that there are 5 g of ____________________ in every 1 L of ____________________ . (3.2)
(d) How well a substance will dissolve in a solvent is defined as the substance's ____________________ . (3.2)

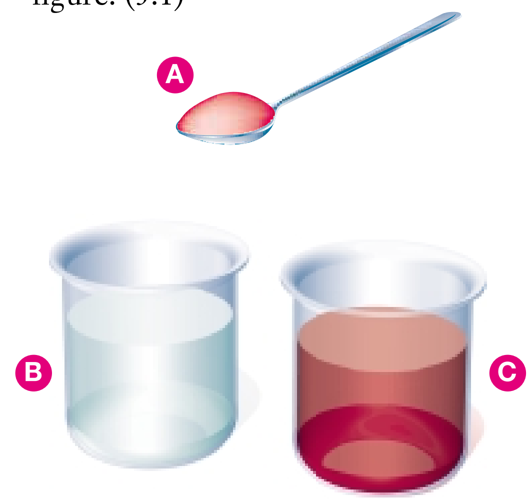
Understanding Key Ideas

Section numbers are provided if you need to review.

3. Classify the following as solutions or mechanical mixtures. (3.1)
(a) apple juice
(b) tomato juice
(c) vinegar
(d) Italian salad dressing
(e) nail polish remover
(f) chocolate chip cookies
(g) soda pop

4. Do most solutes dissolve better in warm water or in cold water? Explain why. (3.2)

5. Identify the solute, solvent, and solution in the figure. (3.1)



Developing Skills

6. Draw an example of a mechanical mixture. (3.1)

7. How could you make a solute dissolve more quickly? (3.2)

8. Hummingbirds like sugar water with a concentration of 300 g/L. When you try to mix this solution, some sugar remains undissolved at the bottom of the container. What can you do to make sure that more of the sugar will dissolve? (3.2)

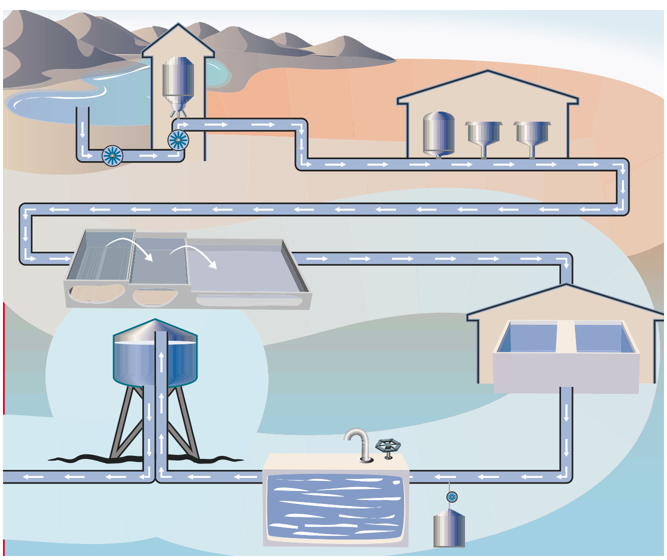
Problem Solving/Applying

9. Write out a procedure you could use to separate a mixture of sugar, sand, and thumbtacks. (3.3)

10. Smog is a mixture of gases and dust. How could you remove the dust from this dirty air so it would be safe to breathe? (3.3)

11. A lab technician mixes a sugar solution by dissolving 10 g of sugar in enough water to make 1 L of solution. What is the concentration of this solution? (3.2)

12. Explain the steps in the water treatment process shown below. (3.3)



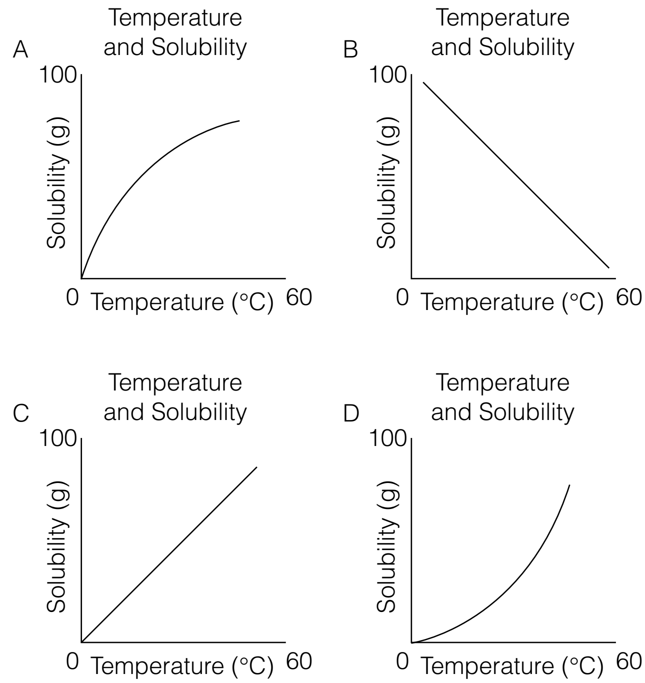
Critical Thinking

13. Describe how you might separate the sugar from the vinegar in a sugar–vinegar solution. (3.3)

14. Although fats and oils are not soluble in water, soapy water cleans greasy dishes. Explain how it does this. (3.2)

15. You are refilling a pepper shaker when it overflows into the sugar bowl. How can you separate the pepper from the sugar? (3.3)

16. Which graph shows the relationship between increasing temperature and solubility? (3.1)



Pause& Reflect

1. Unsafe water is a major cause of disease and death in many majority world countries. Write down some methods that could be used to make sure people everywhere have safe water to drink.
2. Check your original answers to the Getting Ready questions on page 40 at the beginning of this chapter. How has your thinking changed? How would you answer those questions now that you have investigated the topics in this chapter?