DATE: NAME: CLASS:

UNIT 3

Unit 3 Summary

BLM 3-1

Goal • Use this summary to review the concepts in Unit 3, Mixtures and Solutions.

Chapter 7 Matter can be classified as mixtures or pure substances.

- Matter can be either mixtures or pure substances. (7.1)
- Mixtures may be either heterogeneous or homogeneous. (7.1)
- Homogeneous mixtures (solutions) have the same properties throughout. (7.1)
- Heterogeneous mixtures have different visible parts with different properties. (7.1)
- Matter is either a mixture or a pure substance based on the types of particles that make it up. (7.2)
- Each pure substance has its own type of particle, which is different from the kinds of particles that make up all other pure substances. (7.2)

Chapter 8 Some substances dissolve to form solutions faster and more easily than others.

- In a solution, the substance that dissolves is the solute, and the substance in which the solute dissolves is the solvent. (8.1)
- A substance is soluble in a solvent if it dissolves in the solvent. A substance is insoluble in a solvent if it does not dissolve in the solvent. (8.1)
- A concentrated solution has a larger mass of solute for certain volume of solvent. A dilute solution has a smaller mass of solute for a certain volume of solvent. (8.2)
- Solution concentration may be expressed in units of grams of solute per litre of solvent (g/L). (8.2)
- A solution is saturated when as much solute has dissolved in a solvent as it can, at a certain temperature. (8.2)
- Different solutes have different solubilities, which may be increased by increasing the temperature. (8.2)
- Stirring a solution increases the rate of dissolving but not the solubility of the solute. (8.2)

Chapter 9 Many useful products depend on technology for separating mixtures and solutions.

- Heterogeneous mixtures may be separated by methods that include sorting by hand, mechanical sorting, and filtration. (9.1)
- Mechanical sorting of a mixture is based on properties such as particle size and magnetism. (9.1)
- Homogeneous mixtures may be separated by methods that include evaporation, distillation, and paper chromatography. (9.1)
- Petroleum is a complex mixture that can be separated by fractional distillation. (9.2)
- An ore is a rock mixture that has one or more valuable substances. (9.2)

DATE: NAME: CLASS:

UNIT 3

Unit 3 Key Terms

BLM 3-2A

Goal • Use this word search puzzle to review Key Terms from Chapter 7.

Create a list of 9 words from the descriptions below. Then find the words in the puzzle that follows.

1. A solid solution of a metal dissolved in another metal (5 letters)	
2. A combination of two or more types of matter that retain their own properties and that can be detected fairly easily (13 letters)	
3. A combination of two or more types of matter that retain their own properties and look to be the same throughout (11 letters)	
4. Anything that has mass and takes up space (6 letters)	
5. Anything that is not a pure substance (7 letters)	
6. What all matter is made up of (9 letters)	
7. Characteristics that help us describe and identify matter (10 letters)	
8. Matter with only one type of particle (13 letters)	
9. A homogeneous mixture is this (8 letters)	

S	E	Z	J	D	T	S	T	Z	S	X	S	T	M	W
U	O	S	J	E	N	O	O	Y	E	E	S	A	I	U
O	E	Z	U	G	Y	N	D	L	I	O	T	H	X	A
E	N	P	E	O	A	C	B	T	U	T	E	I	T	Y
N	V	H	M	C	Q	P	R	D	E	T	O	R	U	U
E	B	O	M	D	X	E	G	R	E	L	I	N	R	N
G	T	L	A	V	P	V	T	R	K	W	D	O	E	Q
O	T	D	V	O	M	R	O	G	F	N	K	B	N	A
M	M	H	R	B	D	G	Z	Q	C	K	N	M	G	S
O	G	P	G	E	E	Q	V	X	J	Y	O	L	L	A
H	T	E	C	N	A	T	S	B	U	S	E	R	U	P
I	X	C	E	P	A	R	T	I	C	L	E	S	V	T
D	D	O	R	M	H	C	W	C	F	W	Z	R	X	G
Y	U	S	F	A	T	E	K	A	E	Y	N	S	D	B
S	E	V	W	C	G	W	Q	V	J	H	C	H	L	S

Unit 3 Key Terms

Goal • Use this word scramble puzzle to review Key Terms from Chapter 7.

Unscramble each of the clue words. Using the letters found in the numbered squares, complete the message below. Hint: It helps us to explain matter and the way it behaves.

LISNOOTU

		6		4	5		

LYLAO

2			11	13

MUTXERI

15			8		3	16

PUER

1		12	

NEGEOSOHMOU

9	14				7		10			

					C		
1	2	3	4	5		6	7

8	9	10	11	12	13

	F
14	

15	2	4	8	16	3

DATE: NAME: CLASS:

UNIT 3

Unit 3 Key Terms

BLM 3-2C

Goal • Use this word search puzzle to review Key Terms from Chapter 8.

Create a list of 11 words from the descriptions below. Then find the words in the puzzle that follows.

1. A solution in which the amount of solute is high compared to the amount of solvent	
2. What happens to a solute such as sugar when it is mixed with water	
3. A word used to describe a substance such as glass when it is mixed with water	
4. The opposite of the term you found for number 1	
5. A solution that has as much solute dissolved in it for a given temperature	
6. A word used to describe a substance such as motor oil when it is mixed with gasoline	
7. The amount of solute that will dissolve in a given quantity of solvent at a certain temperature	
8. Another name for a homogeneous mixture	
9. A word used to describe a mixture such as salt water in which you can still dissolve more salt	
10. Term used for what you mix into a substance such as water to form a solution	
11. Term used for what you mix with a substance such as salt to form a solution	

Q	D	P	R	D	E	T	A	R	U	T	A	S	N	U
Y	E	N	F	I	P	Q	B	P	B	R	Y	M	K	W
A	T	O	T	L	C	Y	K	P	W	T	O	R	Z	A
M	A	I	E	T	U	L	I	D	I	M	T	R	E	U
I	R	T	F	R	K	T	D	L	O	X	O	E	B	T
G	T	U	E	R	G	E	I	S	B	T	I	V	E	D
I	N	L	O	R	S	B	S	G	V	O	W	R	B	Y
F	E	O	C	F	U	E	S	O	L	U	B	L	E	O
H	C	S	G	L	T	T	V	U	L	E	R	B	E	E
G	N	X	O	D	D	T	A	L	S	V	E	R	S	F
E	O	S	I	I	J	I	N	O	O	F	E	G	L	Q
A	C	P	G	A	R	Z	G	J	L	S	F	N	K	R
E	L	B	U	L	O	S	N	I	U	M	S	H	T	G
D	E	T	A	R	U	T	A	S	T	I	I	I	P	C
F	Y	M	F	J	R	H	U	X	E	D	S	I	D	V

DATE: NAME: CLASS:

UNIT 3

Unit 3 Key Terms

BLM 3-2D

Goal • Use this word scramble puzzle to review Key Terms from Chapter 8.

Unscramble each of the clue words. Then copy the letters in the numbered squares to other squares that have the same number to spell out the word you would use to describe a 320 g/L salt water solution.

l	o	l	b	u	e	s
	15		13		12	3

l	e	u	d	i	t
9				4	

t	o	u	l	s	e
10	11				

u	r	s	t	a	a	d	t	e
	6	7						

s	u	g	o	n	m	e	o	o	h	e
			1			2	8			

m	e	i	t	x	r	u
	14				5	

c	1	2	c	3	2	4	5	6	7	8	9
10	11	12	13	7	14	15	2				

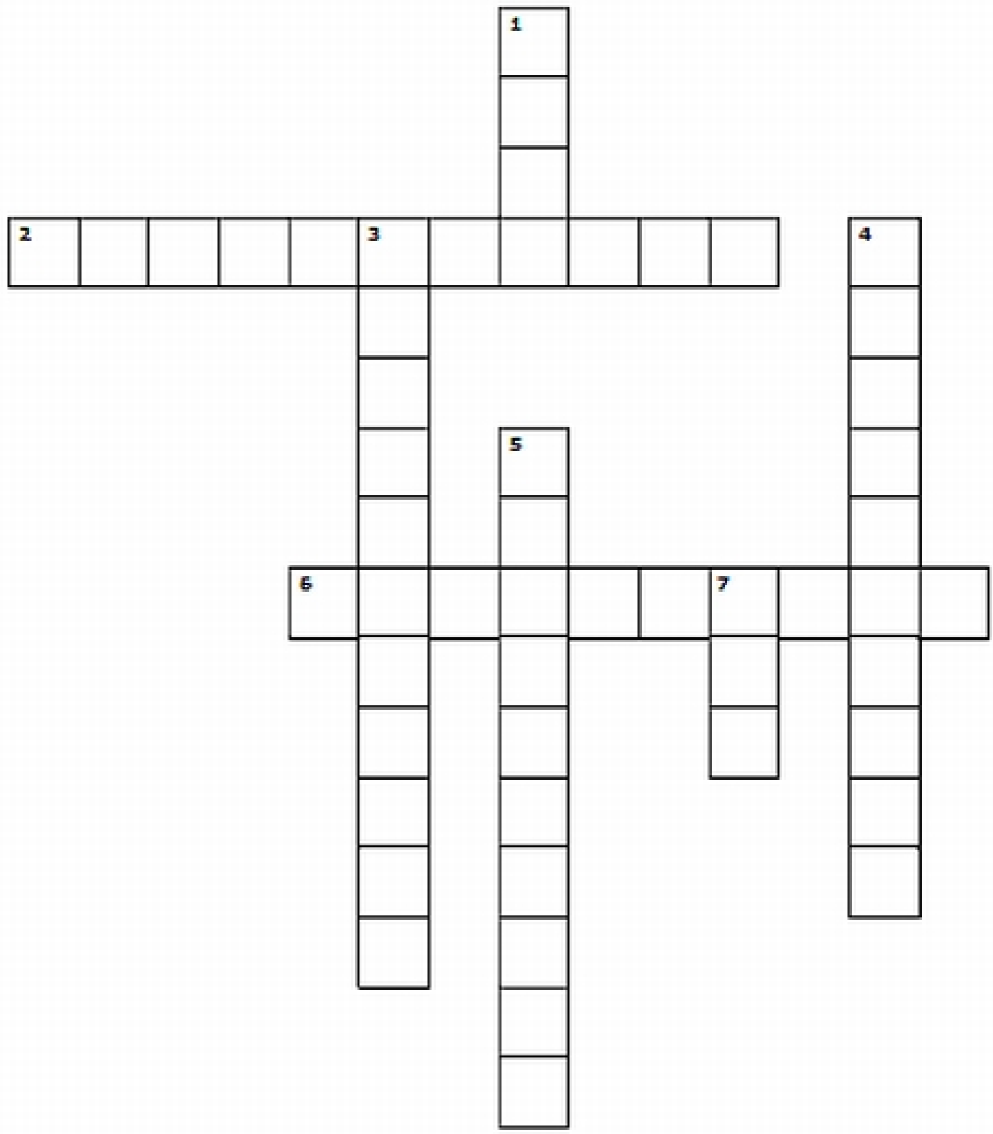
DATE: NAME: CLASS:

UNIT 3

Unit 3 Key Terms

BLM 3-2E

Goal • Use this crossword puzzle to review Key Terms from Chapter 9.



Across

2. distillation and condensation could be used to separate these types of mixtures
6. type of distillation used to separate the parts of a complex mixture

Down

1. gold and iron are examples of this type of substance
3. a method that recovers the solute but not the solvent from a solution
4. a separation method you would use to make tea
5. a type of separation that depends on properties such as magnetism
7. a rock mixture that contains valuable substances such as gold

Unit 3 Key Terms

Goal • Use this word search puzzle to review Key Terms from Chapter 9.

Unscramble each of the clue words. Then take the circled letters and unscramble them to find a phrase that describes what you have been learning about in this unit.

O R S T

◯	◯		◯

I L E F T R

		◯	◯		◯

I M E L P S

◯		◯			◯

A E P O E V R T A

						◯		

N D I C S E N T A O O N

			◯			◯				◯	◯

I G I L O N B P N O T I

										◯	◯	

		X		U			

			U					

Reviewing Physical Properties

Goal • Review a variety of physical properties of matter.

What are Physical Properties?

A property of matter is any characteristic or feature that helps to describe matter. A physical property of matter is any property that you can observe or measure without forming a new substance. Some common physical properties of matter are reviewed below. In Unit 3, you will learn about another physical property of matter: solubility.

State: All matter normally exists in one of three forms, which are called states of matter. The three common states of matter are solid, liquid, and gas.

Density: Density is the amount of mass in a given volume of a substance. Density can be calculated by dividing the mass of a substance (m) by its volume (V).

Melting Point: The temperature at which a substance changes state from a solid to a liquid is called its melting point.

Boiling Point: The temperature at which a substance changes state from a liquid to a gas is called its boiling point.

Malleability: Malleability is the ability of a material to be bent or hammered, stretched, or rolled in all directions.

Transparency: Transparency describes how well you can see through a material—how clear, cloudy, or opaque a material is. Note that coloured substances can be transparent. For example, you can see through apple juice, even though it is coloured.

Elasticity: Elasticity describes the ability of a material to return to its original shape after it has been stretched or compressed.

Viscosity: Viscosity describes how thick or thin a liquid is. For example, a thicker liquid such as molasses is more viscous than a thinner liquid such as water. The more viscous a liquid is, the slower it flows. For example, molasses is more viscous than water, and it flows more slowly than water.

Ductility: Ductility describes the ability of a material to be drawn or stretched out (into the shape of a wire, for instance) without breaking.

Lustre: Lustre describes how shiny or dull the surface of a material is because of the amount of light that reflects from it.

Strength: The ability of a material to resist forces that squeeze or press on it is called its strength.

Texture: The “feel” of a material’s surface—whether it is soft, rough, smooth, or grainy, for example—is its texture.

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CHAPTER 7 **Now You See It Observation Chart** BLM 3-4

Goal • Record your results for Find Out Activity 7-1A, Now You See It, and answer the questions that follow.

Title: ____________________

Observable Properties	Sugar	Water	Sugar-Water Mixture (Initial Appearance)	Sugar-Water Mixture (After 24 h)
Colour				
State (solid, liquid, or gas)				
Transparency (clear, cloudy, or opaque)				

What Did You Find Out?

1. The three statements below compare the properties of the sugar-and-water mixture with the properties of the sugar and the properties of the water. Choose the statement that you think is the most accurate. Record it, and give reasons for your choice.

   - The mixture has all the properties of water and only these properties of the water.
   - The mixture has all the properties of sugar and only these properties of the sugar.
   - The mixture has some of the properties of sugar and some of the properties of water.

   ____

   ____

   ____

   ____

2. You know that the mixture you made has two parts: sugar and water. However, the mixture looks like it has only one part. Think about what you have learned about the particle model. (Review Section 5.1.) In the space below, make a sketch to show what you think the particles in the sugar-water mixture look like. Add labels and a caption to explain your sketch.

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CHAPTER 7

Mixture Match-Up Observation Chart

BLM 3-5

Goal • Record your results for Find Out Activity 7-1B, Mixture Match-Up.

Title: ______________________________

Product	Classification (Heterogeneous, Homogeneous, or Other)	Reasons

DATE: NAME: CLASS:

CHAPTER 7

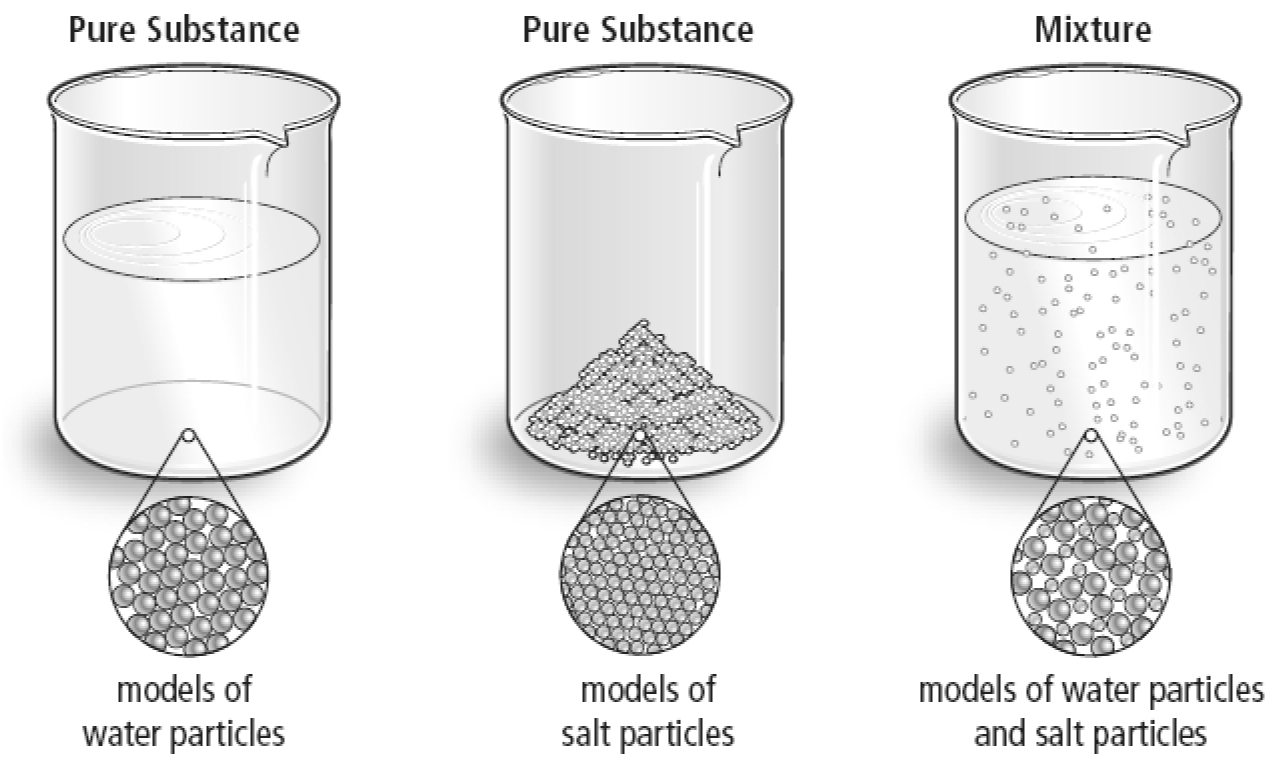
Comparing Particles in a Pure Substance and a Mixture

BLM 3-6

Goal • Summarize how the particles in pure substances and mixtures differ.

A pure substance is matter that is the same throughout. Every sample of a pure substance always has the same properties, because it is made up of exactly the same kind of particles.

Pure substances are different from mixtures, because their compositions are different. A mixture is composed of two or more types of matter, so a mixture has two or more different kinds of particles. The different particles in a mixture keep their own properties.



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CHAPTER 7

A Particle View of the States of Matter

BLM 3-7

Goal • Review your understanding of the particle theory of matter as it applies to states of matter.

What to Do

Four main points of the particle theory of matter are listed below. Use these points to explain the statements that follow.

Main Points of the Particle Theory of Matter

- All matter is made up of tiny particles.
- These particles are always moving—they have energy.
- There are empty spaces between the particles.
- There are forces of attraction between the particles.

Statements

According to the particle theory of matter:

Statement 1. Solids have a definite shape because:

____

Statement 2. Liquids and gases flow because:

____

Statement 3. Ice cream melts on a hot day because:

____

Statement 4. Adding enough energy to a liquid makes it change into a gas because:

____

Statement 5. The particles of a gas are farther apart than the particles of a solid because:

____

6. Bonus question: True or false—the spaces between the particles that make up matter are filled with air. If false, explain why it is false.

____

____

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CHAPTER 7

Examining Three Common Beverages Table of Observations

BLM 3-8

Goal • Record your results for Conduct an Investigation 7-1C, and answer the questions.

Title: ____

Beverages	Method of Observation	Observation	Inference (heterogeneous or homogeneous)	Reasons
Milk	Unaided eye			
	Microscope			
Orange juice	Unaided eye			
	Microscope			
Soda water	Unaided eye			
	Microscope			

Analyze

1. When you examined the beverages with your unaided eye, you looked for different types of matter with different properties within each liquid.
(a) Which types of matter were big, small, or microscopic?
(b) Were the types of matter all the same shape?
(c) Explain which types of matter were solids, liquids, or gases.

2. Describe what, if anything, you were able to see with the magnifying glass that you could not see with your unaided eye:
(a) in the milk
(b) in the orange juice
(c) in the soda water

3. (a) Which beverage appeared to be homogeneous until you saw what it looked like under the microscope?
(b) Describe the new evidence that you observed.
(c) Under high power, you could see bits of different matter with different properties, but the bits were not all exactly the same size and shape. What reasons can you give to explain the differences?

4. Summarize your findings. Write one or two sentences about each beverage. Be sure to state whether it is heterogeneous or homogeneous. Give reasons for your answers.

Conclude and Apply

1. What would you have to observe before you would be willing to identify a mixture as homogeneous? Explain your answer.

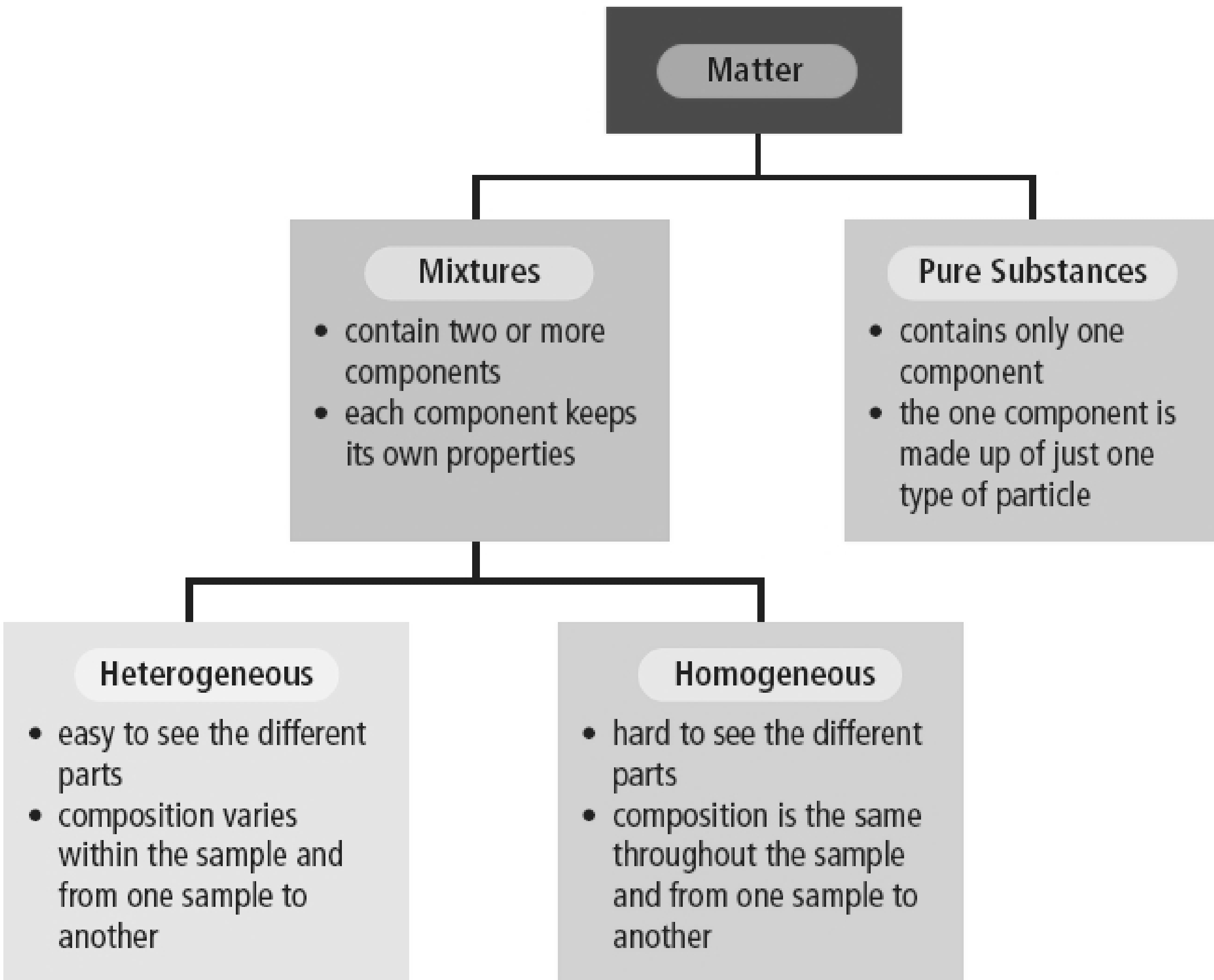
CHAPTER 7

A Classification of Matter

BLM 3-9

Goal • Review a classification flowchart for matter.

Matter can be classified as either a mixture or a pure substance. Mixtures can be classified further as heterogeneous or homogeneous.



Shine On Observation Chart

Goal • Record your observations for Conduct an Investigation 7-2A, Shine On, and answer the questions that follow.

Title: ____

Beaker	Appearance After Stirring	Appearance With Beam of Light
1 (starch and water)		
2 (salt and water)		
3 (water)		

What Did You Find Out?

1. Is the starch-water mixture homogeneous or heterogeneous? Give evidence to support your answer.

____

____

2. Is the salt-water mixture homogeneous or heterogeneous? Give evidence to support your answer.

____

____

DATE: NAME: CLASS:

CHAPTER 7

What Kind of Mixture Observation Chart

BLM 3-11

Goal • Record your observations for Conduct an Investigation 7-2B, What Kind of Mixture, and answer the questions that follow.

Title: ______________________________

Mixture	Prediction: Heterogeneous Mixture or Solution	Observations Before Filtering	Observations After Filtering	
			On Filter Paper	In Beaker
1				
2				
3				
4				

Analyze

1. Which of your observations matched your predictions? Did any observations surprise you? Explain why or why not.

____

____

____

Conclude and Apply

1. If you observe matter on the filter, can you state that the mixture is definitely heterogeneous? Explain your answer.

____

____

____

2. If you do not observe any matter on the filter, can you state that the mixture is definitely a solution? Explain your answer.

____

____

____

From Heterogeneous to Homogeneous

Goal • Do these activities to see how milk can be changed to a homogeneous mixture.

Milk is a heterogeneous mixture. In these activities, you will use milk to make homogeneous mixtures. First you will use milk and vinegar to make plastic. Then you will use skim milk and other substances to make casein glue. ("Casein" is another name for the curds that form when milk goes sour.)

Activity 1: Making Plastic

What you Need

- small pot and hot plate
- strainer and filter paper
- small jar
- paper towel
- 5 mL vinegar
- 125 mL milk

What To Do

1. Heat 125 mL of milk in the pot, stirring continually until small curds (lumps) form.
2. Hold the strainer (lined with a filter paper) over the sink. Pour the heated milk through the strainer to separate the curds from the remaining liquid.
3. Put the curds in the jar. Add the vinegar.
4. Let this new mixture stand for about 1 h. A rubbery blob will form.
5. Slowly pour off the liquid.
6. Shape the blob into an object, such as a ball or a car.
7. Leave the object to harden for a few hours on a paper towel. Then, if you wish, you can colour it with acrylic paints.

Activity 2: Making Glue

What You Need

- stainless steel or enamel pot
- container for glue
- 500 mL skim milk
- 90 mL vinegar
- 60 mL hot water
- 25 mL baking soda

What to Do

1. Put 500 mL of skim milk in the pot, and then add 90 mL of vinegar. Heat and stir until curds form.
2. Pour the curdled milk into a container. When it cools, pour off the clear liquid on the top.
3. Dissolve 25 mL of baking soda in the hot water.
4. Add the solution to the curdled milk. A thick, smooth, cream-coloured, glue-like liquid will form.
5. Test your glue by pasting together two sheets of paper. Let the glue dry thoroughly, then try to separate the paper.

Chapter 7 Review

Goal • Check your understanding of Chapter 7.

What to Do

Circle the letter of the best answer.

1. What is the name used for the mixture that results when sugar is dissolved in water?
A. heterogeneous mixture
B. homogeneous mixture
C. homozygous mixture
D. pure substance

2. Which is a homogeneous mixture?
A. ocean water
B. smog-filled air
C. stainless steel
D. vinegar and oil salad dressing

3. Why do two samples of the same pure substance always have the same properties?
A. They are both made up of identical tiny particles.
B. They are both made up of tiny particles.
C. They are both made up of tiny particles with the same spacing.
D. They are both solutions.

4. What feature of solutions makes them homogeneous?
A. They form a mixture of mixtures.
B. They have the same properties throughout.
C. They form a pure substance.
D. They look the same throughout.

5. Which would help you decide if a mixture is homogeneous or heterogeneous?
A. Measure its mass and volume so you can determine its density.
B. Shine a light through it to see if the light is scattered.
C. Use a balance to determine its mass.
D. Use a graduated cylinder to see if more than one type of matter is present.

6. Which best explains why heterogeneous and homogeneous mixtures are different from pure substances?
A. A mixture is composed of particles that have the same properties throughout.
B. The composition of a pure substance is different from the composition of a mixture.
C. The mixture is made of two or more particles with the same properties throughout.
D. The properties of a pure substance are different from the properties of a mixture.

Match the term on the left with the best description on the right. Each description may be used only once.	
Term	**Description**
_____ 7. heterogeneous _____ 8. alloy _____ 9. homogeneous _____ 10. pure substance _____ 11. solution _____ 12. mixture	A. matter that is made up of just one type of particle B. a mixture that is made up of two or more visible parts C. matter that is not classified as a pure substance D. a heterogeneous mixture E. a homogeneous mixture F. a mixture that is made up of a metal dissolved in another metal G. a mixture that is made up of two or more parts that have the same properties throughout H. matter that is made up of particles with mostly empty space between them

Short Answer Questions

13. Read the descriptions below. In the space provided, indicate whether each mixture is a heterogeneous mixture (H) or a solution (S).

___ (a) The different substances in this mixture can be distinguished from each other with the unaided eye or a magnifying glass.

___ (b) The substances in this mixture cannot be separated by filtering.

___ (c) When the mixture is left to stand undisturbed, the substances do not separate by floating to the top or settling to the bottom.

___ (d) This mixture appears cloudy. You cannot see through it clearly.

14. Air can be classified as heterogeneous or homogeneous. Explain why this statement is **true**.

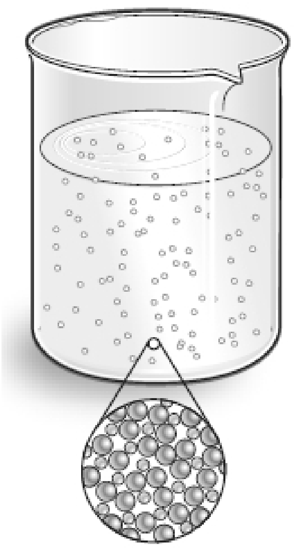
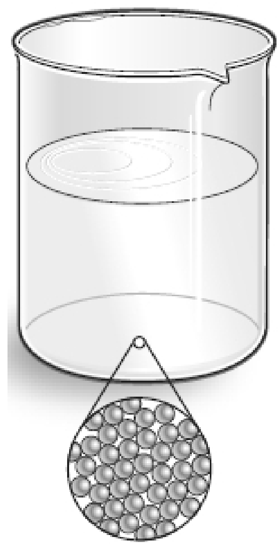
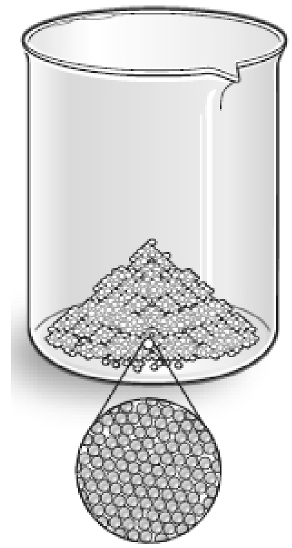
____

____

____

15. Sometimes a pure substance such as a copper coin might be confused with a solution such as a bronze coin. Explain how this could happen.

16. Examine the three illustrations below. Identify the beaker that contains a pure substance, a heterogeneous mixture, or a homogeneous mixture. Explain how you decided.

I	II	III
		

17. To the unaided eye, a mixture appears to be a white liquid with no visible substances floating in it. Can this mixture be classified as homogeneous? Explain why or why not.

DATE: NAME: CLASS:

CHAPTER 8 | BLM 3-14

Does It Dissolve Observation Chart

Goal • Record your observations for Conduct an Investigation 8-1C, Does It Dissolve, and answer the questions that follow.

Title: ____

Container	Name of Solvent	Name of Solute	Observations
1			
2			
3			
4			

What Did You Find Out?

1. Write a summary of your results.

____

____

2. Were your predictions accurate? Explain why you think they were or where not.

____

____

3. Predict what would happen if you did this activity again using ethanol (a type of alcohol) as a third solute. Give reasons to explain your prediction.

____

____

Attraction Among Particles Comic Strip

Goal • Complete this activity to show your understanding of how substances dissolve.

Think About It

In this activity, you will create your own comic strip to show how a jug of water and some powdered drink crystals become a refreshing fruit-flavoured drink.

What to Do

1. In the space below, write all the ideas that you will need to explain what happens when powdered drink crystals dissolve in a jug of water. (Remember to include ideas from the particle theory of matter.)

____

____

____

____

2. Use the space below to plan each frame of your comic strip. For instance, you could have one frame for each idea you listed. Sketch the characters and include their speech and thoughts in word balloons.

3. In the space below, draw your comic strip. Include a title in the first frame.

DATE: NAME: CLASS:

CHAPTER 8

How Stains Are Removed

BLM 3-16

Goal • Read this handout to learn how stains are removed from fabrics.

The making of products that will remove stains from clothing and other fabrics is an example of how knowledge about solvents is used in manufacturing. Read the information below to find out how stain-removing products work. Then check to see how many of these products your family has at home.

Removing Stains

Many stains are not soluble in water, so they are hard to remove from clothing. To remove a stain from fabric, it is important to choose a solvent whose particles attract the particles of the stain.

For a solvent to work, the particles of the stain must be more attracted to the particles of the solvent than to each other. There also must be enough particles of the solvent to surround and attract the stain particles away from the fabric.

The particles of the solvent work at separating the particles of the stain from each other in much the same way that water particles work at dissolving a salt or a sugar crystal. When the particles of the stain have been separated from each other, they are carried away with the solvent when the fabric is washed.

Solvents in Your Home

Consumers want a product that will remove stains, but they also want the products to be safe to use. Check your home for stain-removing products and read their labels. List the ones that are safe to use without special precautions and the ones that require special handling.

Safe to use:

____

____

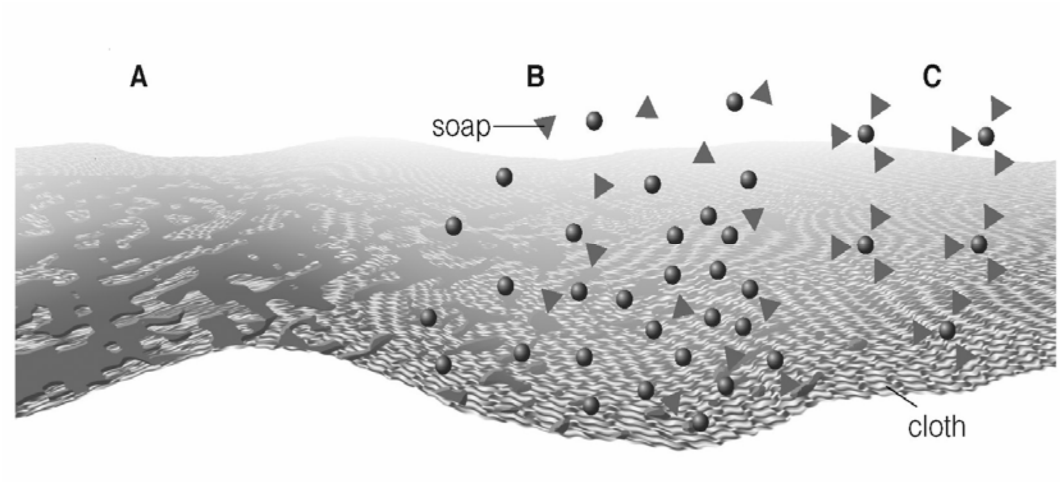
____

Require Special Handling:

____

____

____


A
B
C
soap
cloth

Alternative Cleaners

Goal • Compare a variety of substances for their ability to remove fabric stains.

Stain-removing cleaners such as bleaches and detergents contain chemicals that are harmful to people and pets. They are also washed down the drain and can pollute our water systems. In this activity, you will test the effectiveness of five household substances in removing stains from cotton fabric.

What You Need

- 5 small plastic or paper cups
- 5 eye droppers
- measuring cup
- old toothbrush
- fine marking pen
- 4 pieces of white cotton fabric
- 4 materials to make stains: grass clippings, tea, grape juice, butter
- 5 test solvents: vinegar, club soda, cooking oil, milk, lemon juice

What to Do

1. Pour 50 mL of each test solvent into a separate cup. Label each cup.
2. Place an eye dropper in each cup. Do not mix the droppers.
3. Use the grass clippings to make five small grass stains on one of the cotton pieces. Try to make each stain the same size.
4. Use the pen to mark each stain to show the test solvent you will use for each one. For instance, use “O” for cooking oil and “M” for milk.
5. Place four equal-sized drops of cooking oil on one of the grass stains.
6. Scrub the spot with the toothbrush for 15 s. Thoroughly rinse the toothbrush afterwards with warm tap water.
7. Repeat steps 5 and 6 for each of the other test solvents.
8. Rinse out the fabric with warm water and spread it out on the counter to dry.
9. Repeat steps 3 to 7 for each of the other three stain-making materials.

DATE: NAME:

BLM 3-17 continued

What Did You Find Out?

1. Use this table to record how well each solvent worked on each stain.

Test Solvent	Grass Stains	Tea Stains	Grape Juice Stains	Butter Stains
cooking oil				
milk				
lemon juice				
vinegar				
club soda				

2. Which test solvent removed more stains than the other test solvents? Which removed the fewest stains?

____

____

3. Explain why the test solvents were able to remove some stains but not others?

____

____

4. Name at least two other variables that could affect the effectiveness of the test solvents.

____

____

____

DATE: NAME: CLASS:

CHAPTER 8

Make Your Own Snow Globe

BLM 3-18

Goal • Make a snow globe to demonstrate a saturated solution.

The “snow” in a snow globe is really the result of a saturated solution. In this activity, you will use boric acid crystals for the snow. Boric acid has a solubility in water of 47.2 g/L at 20°C. Only a small amount is needed to form a saturated solution. When you shake the jar, the undissolved crystals float, like snowflakes, before settling to the bottom of the jar. **CAUTION! Boric acid can be toxic if taken internally or inhaled. Wear safety glasses, a lab coat, and gloves when handling this chemical. Refer to the Material Safety Data Sheet (MSDS) before you use this chemical.**

What You Need

- 50 mL boric acid crystals
- small, clear plastic jar with a wide mouth and tight-fitting lid
- tiny plastic objects (optional)
- glue (water-proof)
- water

What to Do

1. Pour 50 mL of boric acid crystals in the jar.
2. Slowly fill the jar to the brim with water.
3. Glue objects such as tiny plastic buildings and trees to the inside of the lid. When the glue has dried, screw the lid on tightly.
4. Turn the jar over and shake it to mix the crystals and water.

What Did You Find Out?

1. Why are boric acid crystals a good choice for making a snow globe?

___

___

___

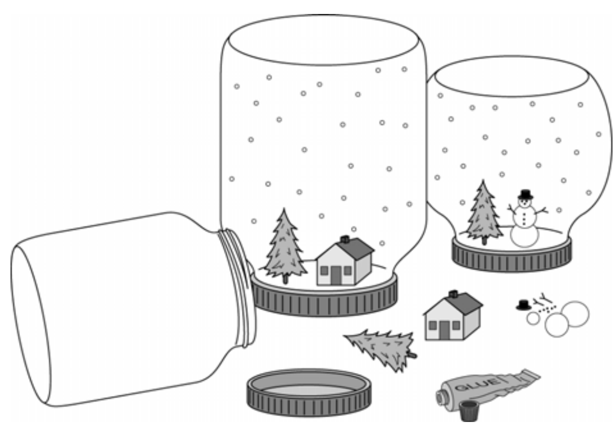
2. At 30°C, 6.23 g/mL of boric acid will dissolve in water. Estimate the solubility of boric acid in water at 25°C. Give reasons for your estimate.

___

___

___

___



DATE: NAME: CLASS:

CHAPTER 8

Solubility Sequencing

BLM 3-19

Goal • Sequence substances in order from most soluble to least soluble.

What to Do

List the substances below in the table so that the most soluble substance is at the top and the least soluble substance is at the bottom.

baking soda: 69 g/L

bluestone: 316 g/L

calcium hydroxide: 1.9 g/L

carbon dioxide: 3.4 g/L

Epsom salts: 700 g/L

limestone: 0.007 g/L

nitrogen: 0.03 g/L

oxygen: 0.07 g/L

salt: 357 g/L

sugar: 1792 g/L

Substance	Solubility in Water (g/L) at 0°C

DATE: NAME: CLASS:

How Does Temperature Affect Solubility?

Goal • Practise your graphing skills and demonstrate your understanding of solubility.

In Conduct an Investigation 8-2A on page 268 of your textbook, you used a line graph to analyze the relationship between temperature and solubility for three solids. In this activity, you will explore how the solubility of a gas, oxygen, changes at different temperatures. The data in the table on the next page was obtained from an experiment in which two students measured the mass of oxygen, in mg, dissolved in 1 L of water at different temperatures.

What to Do

Draw a line graph of the data on the next page. Remember to include the scales and labels for each axis. Add a title across the top of the graph.

Temperature of water (°C)	Mass of oxygen (mg)
0	72
10	56
20	44
30	39
40	34
50	30
60	25
70	19
80	12
90	8

What Did You Find Out?

1. What does your graph indicate about the connection between the temperature of water and the amount of oxygen dissolved in it?

____

____

____

2. Predict how many milligrams of oxygen are dissolved in 1 L of water at 5°C.

____

3. Predict the temperature of the water if it contains 15 mg of dissolved oxygen.

____

Solubility and Temperature (Core Lab)

Goal • Record your answers to Conduct an Investigation 8-2A, How Does Temperature Affect Solubility

Analyze

1. Describe the shape of the lines on your graph.

2. What happens to the lines as temperature increases?

3. Predict the solubility of each solute at 90°C. (Use your dashed line to help you make your prediction.)

4. How did the solubility in warmer water of the substance you tested compare with its solubility in colder water?

Conclude and Apply

1. What happened to the solubility of each solid solute as the temperature of the water increased?

2. How well did your results support your hypothesis?

CHAPTER 8

Concentration of Consumer Products Recording Chart

BLM 3-22

Goal • Record concentration data from Find Out Activity 8-2C, Concentration of Consumer Products

What to Do

1. In your home, look for five products that show their concentration on the label. The chart below shows some ways to recognize how concentration may be expressed on a label.

Unit of Concentration	What It Tells about the Solution
g/L	tells how many grams of solute per litre of solution
ppm (parts per million)	tells the ratio, 1:1 000 000, of the mass of solute in the mass of solution
%	tells the percentage of solute in the solution by volume (in other words, the volume of the solute divided by the total volume of the solution)
%	tells the percentage of solute in the solution by mass (in other words, the mass of solute divided by the total mass of the solution)

Name of Product	Solute	Solvent	Concentration

What Did You Find Out?

1. In the products you listed, what is the most common solvent?

____

2. Why do you think the manufacturer provided concentration information on the label?

____

____

DATE: NAME: CLASS:

CHAPTER 8

Working with Concentration Units Recording Chart

BLM 3-23

Goal • Practice converting to concentrations expressed in grams per litre (g/L).

1. Devise a method to convert from mL to L. Test your method by converting the six units below. Check your answers with the class before going to step 3.

(a) 1000 mL = ___ L

(b) 500 mL = ___ L

(c) 100 mL = ___ L

(d) 10 mL = ___ L

(e) 5 mL = ___ L

(f) 1 mL = ___ L

2. Now devise a method to convert from g/mL to g/L. Check your answers with the class to make sure that everyone understands how to convert the units.

(a) 10 g/100 mL = ___ g/___ L

(b) 52 g/100 mL = ___ g/___ L

(c) 65 g/100 mL = ___ g/___ L

(d) 100 g/100 mL = ___ g/___ L

(e) 137 g/100 mL = ___ g/___ L

(f) 0.15 g/100 mL = ___ g/___ L

DATE: NAME:

BLM 3-23 continued

3. Review your methods closely. Then, convert all the solubilities in Table 8.2 from g/L to g/mL.

Table 8.2 Solubilities of Some Common Substances at 0°C

Substance	State (of Solute)	Solubility in Water (g/L)
baking soda	solid	69
bluestone	solid	316
calcium hydroxide	solid	1.9
carbon dioxide	gas	3.4
Epsom salts	solid	700
ethanol	liquid	unlimited
limestone	solid	0.007
nitrogen	gas	0.03
oxygen	gas	0.07
salt	solid	357
sugar	solid	1792

Substance	Solubility in Water (g/mL)
baking soda	
bluestone	
calcium hydroxide	
carbon dioxide	
Epsom salts	
ethanol	
limestone	
nitrogen	
oxygen	
salt	
sugar	

Chapter 8 Review

Goal • Check your understanding of Chapter 8.

What to Do

Circle the letter of the best answer.

1. Which of the following statements accurately describes a solution of copper in silver?
A. The copper is the solute and the silver is the solvent.
B. The copper is the solution and the silver is the solvent.
C. The silver is the solute and the copper is the solvent.
D. The silver is the solution and the copper is the solvent.

2. Which of the following statements is **true**?
A. Chlorophyll is soluble in water.
B. Gasoline is insoluble in motor oil.
C. Gasoline is soluble in motor oil.
D. Salt is insoluble in water.

3. How is a concentrated solution different from a dilute solution?
A. The concentrated solution has a large mass of dissolved solvent for a certain quanity of solute.
B. The concentrated solution has a large mass of dissolved solute for a certain quantity of solvent.
C. The concentrated solution has a small mass of dissolved solute for a certain quantity of solvent.
D. They both have different solubilities.

4. Which statement best describes what is meant by the term “rate of dissolving?”
A. how fast a mixture must be stirred
B. how fast a solute dissolves in a solvent
C. the solubility of a substance at a given temperature
D. the temperature at which a solute dissolves in a solvent

5. What happens when you remove the cap from a bottle of pop?
A. The pressure inside the bottle lowers very quickly.
B. The pressure inside the bottle remains the same at a certain temperature.
C. The pressure inside the bottle rises very quickly.
D. The solution increases in pressure at a certain temperature.

6. At 0°C, 357 g of salt will dissolve in 1 L of water. At this temperature, why will no additional salt dissolve?
A. The rate of dissolving is equal to its solubility.
B. The solution is concentrated.
C. The solution is saturated.
D. The solution is unsaturated.

Match the term on the left with the best description on the right. Each description may be used only once.	
Term	**Description**
______ 7. solute ______ 8. solubility ______ 9. solution ______ 10. solvent ______ 11. saturated ______ 12. soluble	A. describes a substance that will dissolve in another substance B. the mass of a solute that can dissolve in a certain amount of solvent at a certain temperature C. the mass of a solvent that can dissolve in a certain solute at a certain temperature D. the substance in which something dissolves E. a homogeneous mixture F. the substance that dissolves in another substance G. describes a solution in which no more solute will dissolve at a certain temperature. H. describes a solution in which no more solute will dissolve

Short Answer Questions

13. Give examples of each of the following.

solid-in-solid solutions (1) ______________________ (2) ______________________

liquid-in-liquid solutions (1) ______________________ (2) ______________________

gas-in-gas solutions (1) ______________________

14. Use the particle theory of matter to explain why some substances are soluble in water while other substances are not soluble in water.

____

____

____

____

15. Suppose that you have a solution of table salt dissolved in water. Explain how you could find out whether or not this solution is saturated.

16. The solubility of sugar in water is 1792 g/L at 0°C. How much sugar must be added to 50 mL of water to make a saturated solution at 0°C?

17. The solubility of a substance can be expressed qualitatively and quantitatively. Use examples to explain this statement for sugar dissolved in water.

18. In the space to the right, sketch the shape of a graph that shows how the solubility of sugar in water changes as the temperature of the water increases. Label the axes correctly, and title the graph.

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CHAPTER 9

Settling Undissolved Solids

BLM 3-25

Goal • Observe the settling of undissolved solids in a mixture.

What You Need

- jar with lid
- graduated cylinder
- measuring spoon
- dried beans
- flour
- salt
- water

What to Do

1. Place a handful of dried beans in the jar.
2. Add 10 mL of salt and 20 mL of flour. Then pour 250 mL of water into the jar.
3. Screw the lid on tightly, and shake the jar to mix all the materials.
4. Place the jar on a table and observe. Leave the jar for 20 min. Observe again.
5. In the space below, draw and label the mixture before and after you left it standing.

What Did You Find Out?

1. Which materials in the jar were insoluble? How do you know?

____

____

2. What caused “layers” to form in the jar?

____

____

Growing Salt Crystals

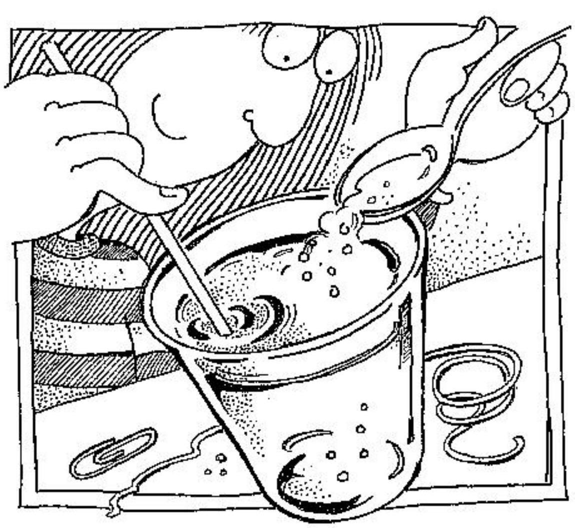
Goal • Use evaporation to separate a solution and to grow salt crystals.

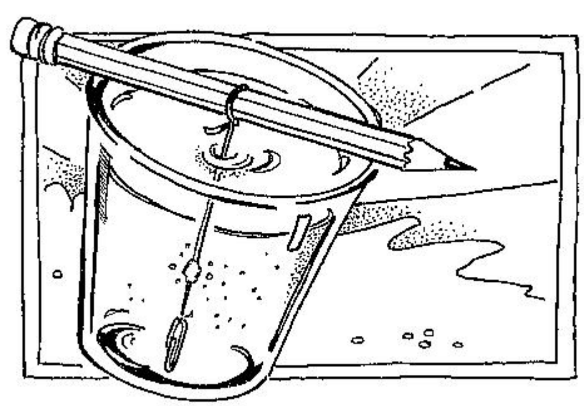
What You Need

- clear plastic container
- stirring rod
- spoon
- pencil
- table salt or Epsom salts
- piece of water-absorbent string or yarn
- water
- paper clip

What to Do

1. Fill the container about half-full with water.
2. Use to spoon to add salt slowly to the water. Stir rapidly with the stirring rod. Keep adding salt until some of it stays undissolved, even after stirring.
3. Tie one end of the string or yarn to the middle of a pencil. Tie the paper clip to the other end of the string.
4. Wet the lower end of the string or yarn with water. Then drag the wet end through a small pile of salt so that a few crystals stick to it, above the paper clip.
5. Put the container in a dry place where it will not be disturbed.
6. Observe the setup each day for up to four days. Use the chart on the next page to record your observations.





Title: ____

Date	**Approximate height of water level**	**Appearance of the crystals attached to the string**

What Did You Find Out?

1. Which part of the solution (solute or solvent) evaporated and which part (solute or solvent) was left behind?

____

____

2. What is the term for a solution in which you have dissolved as much solute as possible?

____

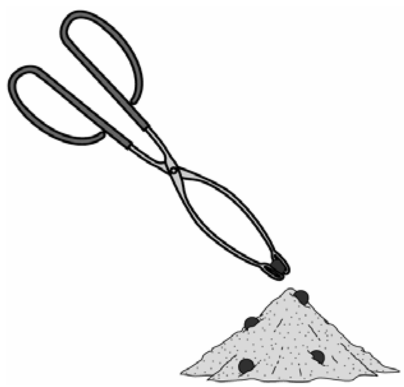
____

Methods of Separation

Goal • Read this handout to review different methods of separating mixtures.

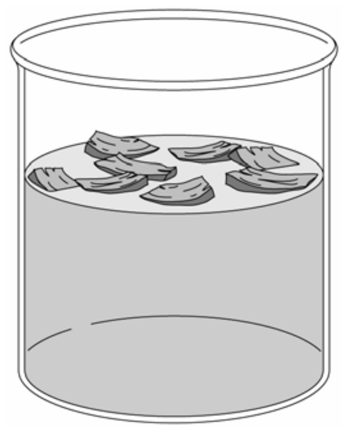
Mechanical Sorting

This method is used to remove large pieces of material from a mixture. For example, tweezers, fingers, or tongs can be used to pick out marbles from a pile of sand.



Flotation

This method separates materials that are less dense than the liquid with which they are mixed. The materials that rise to the top can be scooped out with a spoon. For example, wood shavings float on the surface of water.

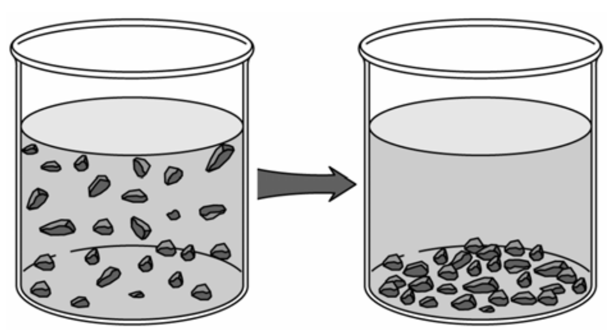


Magnetism

This method uses a magnet to remove any substance that is magnetic. For instance, a magnet can separate and remove thumbtacks from plastic paper clips.

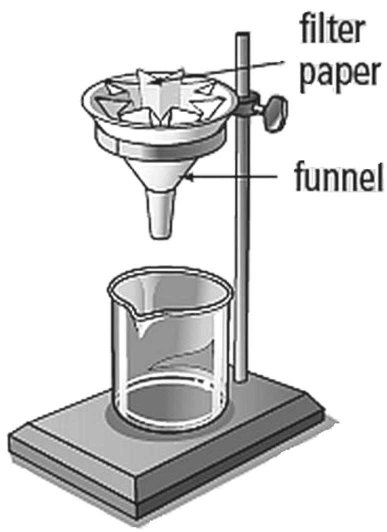
Settling

This method will separate out the heavier materials from the rest of a mixture. When mixed with water, the heavier parts settle to the bottom. For example, gravel settles to the bottom of a water-gravel mixture.



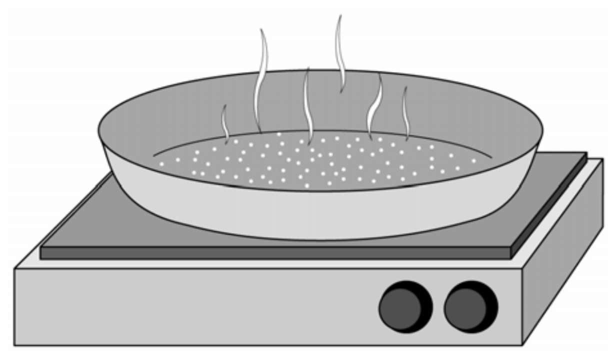
Filtering

This method uses a device such as a sieve or strainer to separate the larger parts from the smaller parts of a mixture. If the parts are very small paper can be used instead. For instance, coffee grounds or clay particles mixed with water can be separated by pouring the mixture through filter paper.



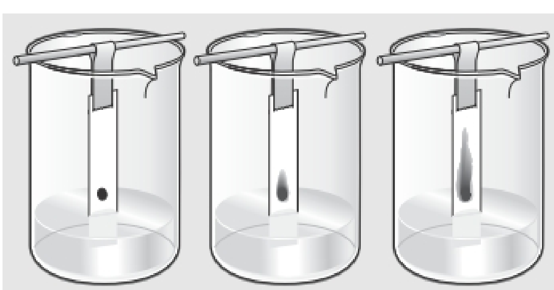
Evaporation

This method is used to separate the solute from a solution by evaporating the liquid portion of the solution. The solute is left behind, but the solvent is not recovered. For example, salt can be separated from salt water by evaporating the water on a stove top or a hot plate.



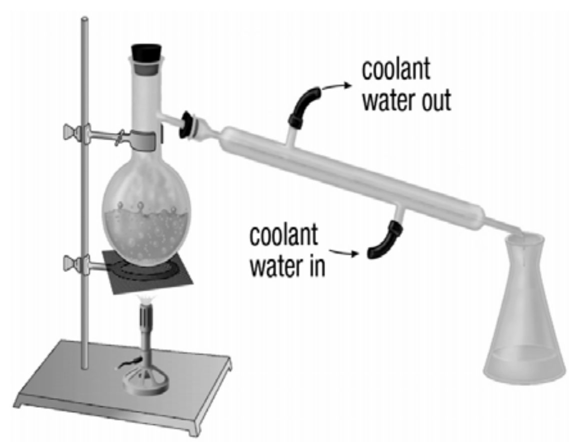
Paper Chromatography

This method separates the coloured substances (pigments) in a solution by comparing the speed that the pigments are carried by a solvent through an absorbent material such as filter paper.



Distillation

This method uses evaporation and condensation to recover the solvent from a solution. For example, pure water can be recovered from ocean water by evaporating it, condensing the vapour, and collecting it. An apparatus such as the one shown below can be used.



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CHAPTER 9

Strategies for Separation Chart

BLM 3-28

Goal • Record your observations for Think About It 9-1A, and answer the questions.

Mixture	Separation Method	Reasons
		1.
		2.
		1.
		2.
		1.
		2.
		1.
		2.
		1.
		2.
		1.
		2.
		1.
		2.

What Did You Find Out?

1. Which properties of matter did you refer to most often?

2. Which methods of separation did you refer to most often?

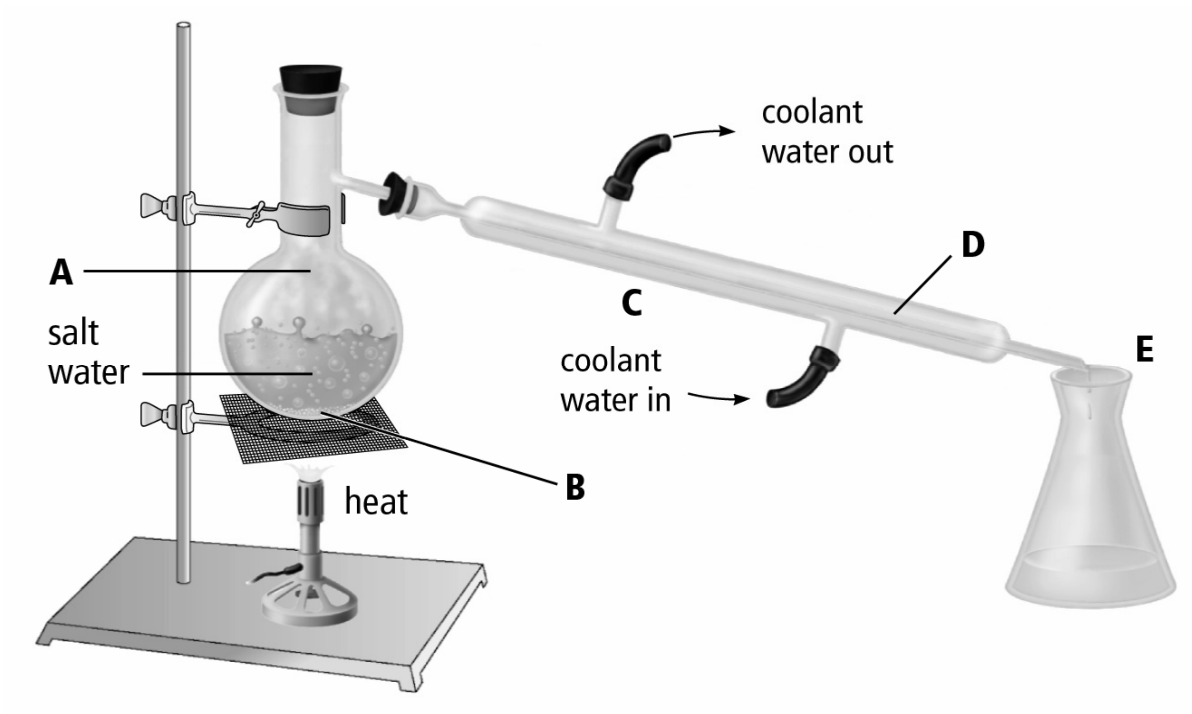
3. (a) Which mixtures would be easiest to separate? Why?

3. (b) Which would be the most difficult to separate? Why?

4. Name the method or methods you would use to separate this mixture: marbles, sand, iron filings. Explain why each method would work.

CHAPTER 9 **Simple Distillation** BLM 3-29

Goal • Identify the components of an apparatus for simple distillation.



1. Identify the state of the substance at **A**, and name it: ______________________________

2. Describe what happens to the solvent and the solute at **B** as heat is applied to the flask.

____

3. What is the name of the apparatus shown at **C**? _________________________________

4. Describe what happens to the substance shown at **D**, say what the purpose of the coolant water is, and identify the substance and its state as it emerges at **E**.

____

____

____

Separating Homogeneous Mixtures Recording Sheet

Goal • Record your answers to the three parts of Conduct an Investigation 9-1C, Separating Homogeneous Mixtures

Part 1: Evaporation

What Did You Find Out?

1. Describe the appearance of the solution in step 1.

____

____

2. Describe the material that remained in the evaporating dish in step 4.

____

____

3. What happened to the water in the solution? (Be sure to identify the change of state.)

____

____

4. (a) What substance likely remained in the evaporating dish? ______________________

(b) Explain why it would be unsafe to use taste to be sure of what substance it is.

____

____

5. Suggest one way that you could collect the water that evaporated.

____

____

Part 2: Distillation

Analyze

1. (a) What did you see in the top half of the flask after the water started to boil?

____

(b) What change of state must have occurred inside the flask? Explain how you know.

____

2. (a) Describe what you saw at the end of the rubber tubing in the beaker (step 4).

____

____

(b) What change of state must have occurred inside the tubing? ___________________

3. After the drops of liquid evaporated from the microscope slide, what (if any) material remained on the slide for

(a) the salt solution? ______________________________

(b) the liquid collected in step 4? ______________________________

(c) the distilled water? ______________________________

4. In steps 4(c) and (d), you rinsed the eye dropper with the liquid that you were going to collect and then put on the microscope slide. What do you think was the purpose of this rinsing process?

____

____

____

Conclude and Apply

1. In step 4, which substance collected in the beaker: the solute or the solvent? Explain how you know.

____

2. What happened to the substance that was not collected in this beaker?

____

3. Which of the three samples in step 5 were probably pure water? Explain your answer.

____

____

4. In your opinion, would distillation be a suitable method for producing large amounts of pure water for a large city? Give reasons to justify your opinion.

____

____

____

____

____

Part 3: Paper Chromatography

Analyze

1. Sketch and describe what you observed on each paper strip.

2. If you had forgotten to label the paper strips, how could you know which marker you had used to make the ink dots?

Conclude and Apply

1. Is ink a mixture of different substances? Justify your answer.

2. Do you think you could put the separated colours together again. Describe what you would do and explain why you think it would work.

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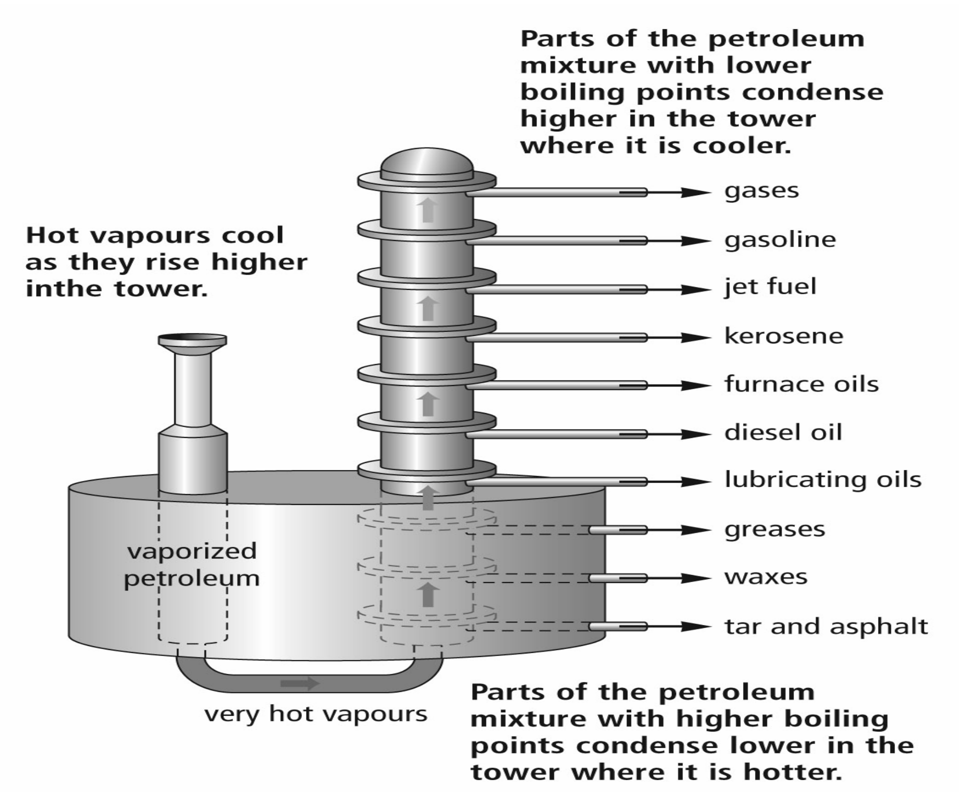
CHAPTER 9 **Fractional Distillation** BLM 3-31

Goal • Describe what happens in a fractional distillation tower.



1. Which has a higher boiling point: kerosene or diesel oil? Explain how you know.

____

____

2. Which has a lower boiling point: gasoline or furnace oils? Explain how you know.

____

____

3. Describe what happens to the temperature of the hot petroleum vapours as they rise higher in the taller tower.

____

____

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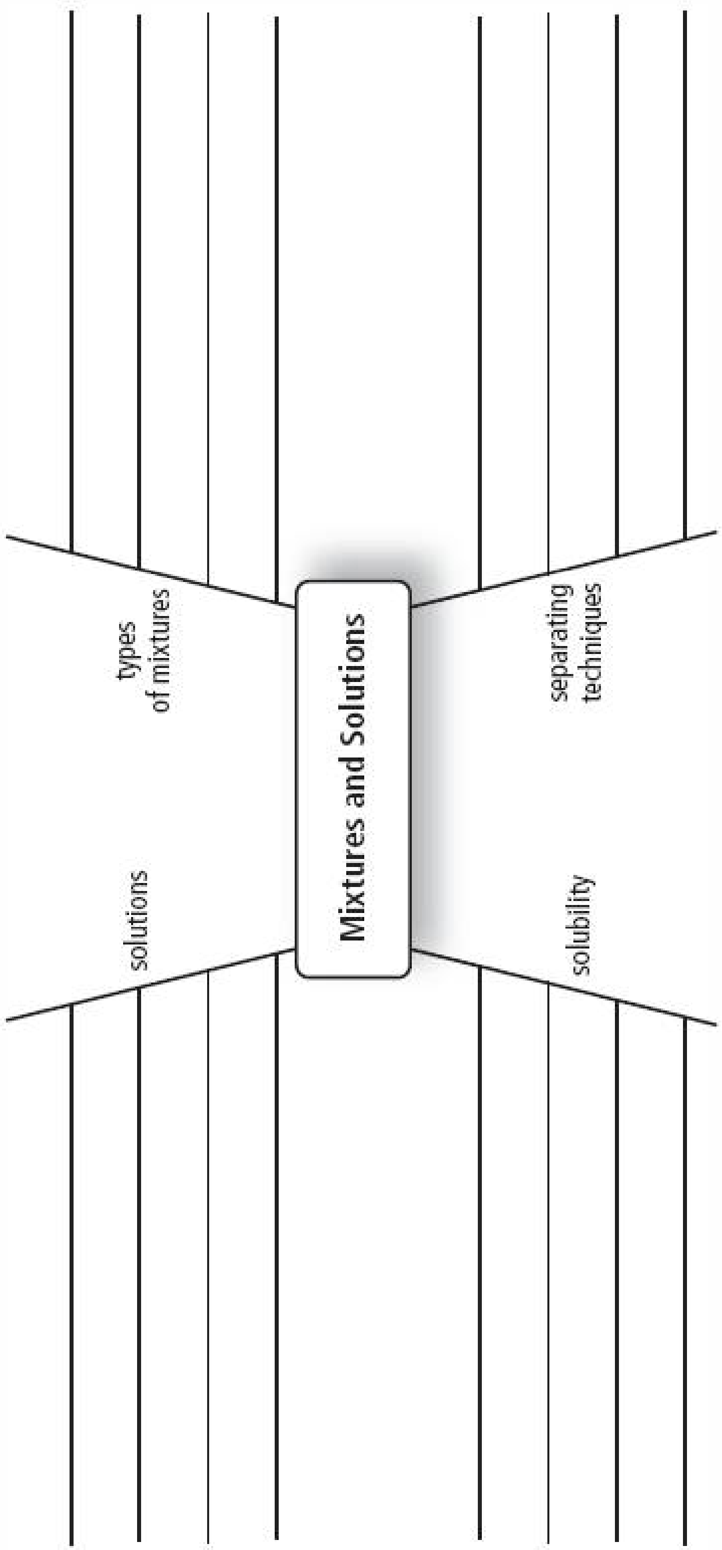
CHAPTER 9

Visualizing Key Ideas Recording Sheet

BLM 3-32



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CHAPTER 9 **Chapter 9 Review** BLM 3-33

Goal • Check your understanding of Chapter 9.

Circle the letter of the best answer.

1. What is the name of the separation method that separates the parts of a mixture based on properties such as particle size and magnetism?
A. mechanical filtration
B. mechanical mixing
C. mechanical sorting
D. mechanized sorting

2. What does the separation method of evaporation enable you to do?
A. recover both the solute and the solvent from a solution
B. recover only the solute from a solution
C. recover only the solvent from a solution
D. recover the solution from a mixture

3. Which of the following separation methods would you use to separate the parts of ink?
A. condensation
B. filter paper
C. paper chromatography
D. simple distillation

4. What happens during the fractional distillation of petroleum?
A. parts of the mixture with higher boiling points condense higher in the tower where it is cooler
B. parts of the mixture with higher boiling points condense lower in the tower where it is cooler
C. parts of the mixture with lower boiling points condense higher in the tower where it is cooler
D. parts of the mixture with lower boiling points condense lower in the tower where it is cooler

5. Why does panning separate gold from sand and gravel?
A. gold floats while sand or gravel settles to the bottom of the pan
B. gold is less dense than pieces of sand or gravel with the same mass
C. gold is so dense that even tiny bits have more mass than pieces of sand or gravel
D. gold is so dense that even tiny bits have more volume than pieces of sand or gravel

6. Which statement best describes petroleum?
A. It is a complex mixture of homogeneous solutions.
B. It is a complex mixture of liquid, solid, and gaseous substances.
C. It is a heterogeneous mixture that is easily separated into its many parts.
D. It is a simple mixture of liquid, solid, and gaseous substances.

Match the term on the left with the best description on the right. Each description may be used only once.	
Term	**Description**
_____ 7. evaporation _____ 8. simple distillation _____ 9. complex _____ 10. chromatography _____ 11. filtration _____ 12. mechanical sorting	A. prevents larger particles from passing through smaller holes B. can be used to separate solid mixtures on the basis of the size of their particles C. can be used to separate mixtures on the basis of the magnetic properties of their particles D. recovers both the solute and solvent from a solution E. recovers only the solute from a solution F. a method used to separate the solvents in a mixture G. describes the nature of a solution such as petroleum H. recovers only the solvent from a solution

Short Answer Questions

13. How can you use properties to separate the visible parts of heterogeneous mixtures?

____

____

14. Explain how filtration works to help protect a carpenter from breathing in sawdust and other particles.

____

____

15. Explain why filtration does not work with homogeneous mixtures.

____

____

____

16. In the space below, sketch and label the main components of the equipment that is used for simple distillation.

17. Describe the role of the property of boiling point in fractional distillation.

____

____

____

18. Explain why simple distillation is not a good separation method for a mixture such as petroleum.

____

____

____

19. Ink from a marking pen is used in a paper chromatography experiment in which water is used to separate the substances dissolved in the ink. After running the experiment, you observe that the ink has not spread out as you expected it would. Infer a reason why, and suggest what you could do to get a more favourable result.

____

____

____

____

Unit 3 Review

Goal • Check your understanding of Unit 3.

Circle the letter of the best answer.

1. Which is the method that is used to separate and recover the parts of a liquid solution?
A. condensation
B. distillation
C. evaporation
D. saturation

2. Which of the following is an example of a solution?
A. oil in water
B. oxygen in air
C. pepper in water
D. dust in air

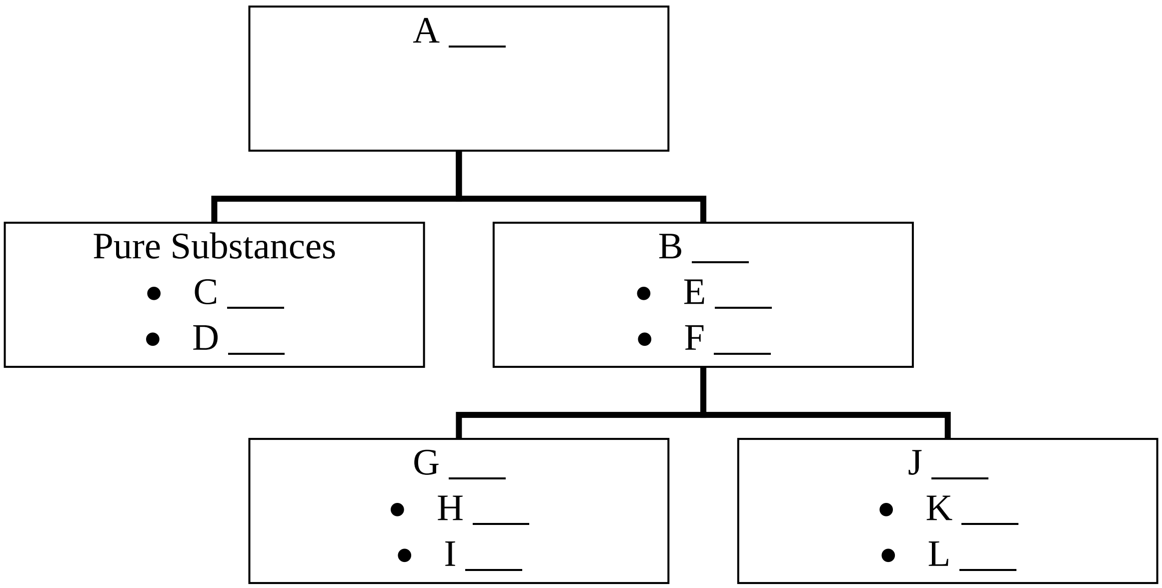
3. Which of the following is a homogeneous mixture?
A. antifreeze
B. gold ore
C. milk
D. petroleum

4. Which of the following lists contains all pure substances?
A. gold, oxygen, carbon dioxide
B. milk, water, copper
C. squeezed orange juice, silver, soda water
D. tea, salt, concrete

5. In the following list of substances, which is the most soluble in water?
A. carbon dioxide
B. ethanol
C. sugar
D. table salt

6. Which of the following labels for the picture below is correct?
A. solute + solvent = solution
B. solvent + solute = saturation
C. solvent + solute = soluble
D. solvent + solute = solution

In the space beside each letter, write the numeral of the choice that is the best match. Each numeral choice may be used only once.



7. Mixtures
8. Homogeneous
9. Heterogeneous
10. Matter
11. contain two or more components
12. composition varies within the sample and from one sample to another
13. hard to see the different parts
14. the one component is made up of just one type of particle
15. composition is the same throughout the sample and from one sample to another
16. each component keeps its own properties
17. easy to see the different parts
18. contains only one component

19. In the space below, write a suitable title for the flowchart.

____

Short Answer Questions

20. One way to increase the rate that a solute dissolves in a solvent is to stir the mixture. Name two other ways to increase the rate of dissolving.

____

21. If a spoonful of cornstarch is added to a glass of water, a cloudy mixture results. Describe two ways to separate the two parts of this mixture.

____

____

22. Many common activities at home and in industry involve separating mixtures. Identify four examples or situations that illustrate this statement.

(1) ____________________ (3) ____________________

(2) ____________________ (4) ____________________

23. The concentration of solutions can be expressed in units that include g/L, ppm, and %. Give one example of a product whose concentration is expressed in each unit.

(1) ____________________ (3) ____________________

(2) ____________________

24. Imagine that you are stranded on a desert island in a tropical region. You have a plastic sheet and a large bowl. There are plenty of rocks and sticks on the island. In the space at the right, make a sketch to show how you could get drinkable water from the ocean water that surrounds your island. Explain how your method works.

Unit 3 BLM Answers

BLM 3-2A, Unit 3 Key Terms

1. alloy
2. heterogeneous
3. homogeneous
4. matter
5. mixture
6. particles
7. properties
8. puresubstance
9. solution

```
S + + + + + S + + + + S + M +
U + + + + + + O + + E + A I +
O + + + + + + + L I + T H X +
E + + + + + + + T U T E + T +
N + + + + + + R + E T + + U +
E + + + + + E + R E + I + R +
G + + + + P + + R + + + O E +
O + + + O + + O + + + + + N +
M + + R + + G + + + + + + + +
O + P + + E + + + + Y O L L A
H + E C N A T S B U S E R U P
+ + + E P A R T I C L E S + +
+ + O + + + + + + + + + + + +
+ U + + + + + + + + + + + + +
S + + + + + + + + + + + + + +
```

BLM 3-2B, Unit 3 Key Terms

solution
alloy
mixture
pure
homogeneous

particle theory of matter

BLM 3-2C, Unit 3 Key Terms
concentrated
dissolves
insoluble
dilute
saturated
soluble
solubility
solution
unsaturated
solute
solvent

+	D	+	+	D	E	T	A	R	U	T	A	S	N	U
+	E	N	+	+	+	+	+	+	+	+	Y	+	+	+
+	T	O	+	+	+	+	+	+	+	T	+	+	+	+
+	A	I	E	T	U	L	I	D	I	+	+	+	+	+
+	R	T	+	+	+	+	+	L	+	+	+	+	+	+
+	T	U	+	+	+	+	I	+	+	+	+	+	+	+
+	N	L	+	+	S	B	S	+	+	+	+	+	+	+
+	E	O	+	+	U	E	S	O	L	U	B	L	E	+
+	C	S	+	L	+	+	V	+	L	+	+	+	+	+
+	N	+	O	+	+	+	+	L	S	V	+	+	+	+
+	O	S	+	+	+	+	+	+	O	+	E	+	+	+
+	C	+	+	+	+	+	+	+	L	S	+	N	+	+
E	L	B	U	L	O	S	N	I	U	+	S	+	T	+
D	E	T	A	R	U	T	A	S	T	+	+	I	+	+
+	+	+	+	+	+	+	+	+	E	+	+	+	D	+

BLM 3-2D, Unit 3 Key Terms
soluble
dilute
solute
saturated
homogeneous
mixture

concentrated solution

BLM 3-2E, Unit 3 Key Terms
1. pure
2. homogeneous
3. evaporation
4. filtration
5. mechanical
6. fractional

BLM 3-2F, Unit 3 Key Terms

sort
filter
simple
evaporate
condensation
boiling point

mixtures and solutions

BLM 3-7, A Particle View of the States of Matter

1. There are forces of attraction between the particles.
2. The particles are always moving—they have energy; and There are empty spaces between the particles.
3. These particles are always moving—they have energy; and There are empty spaces between the particles.
4. These particles are always moving—they have energy.
5. There are empty spaces between the particles.
6. False. The spaces between the particles are filled with nothing. The spaces are empty.

BLM 3-13, Chapter 7 Review

1. B
2. C
3. A
4. B
5. B
6. B
7. B
8. F
9. G
10. A
11. E
12. C
13(a). H (b) S (c) S (d) H
14. Sample answer: Clean air is a solution, so it is homogeneous. "Normal" air often contains visible particulates, so it is heterogeneous.
15. Both pure substances and solutions are homogeneous—they appear the same throughout.
16. Beaker I contains a homogeneous mixture because two types of particles are visible and they appear to be uniform—the same throughout. Beakers II and II both contain pure substances because only one type of particle is visible in each case.
17. The mixture can't be classified conclusively as homogeneous, because (like milk) there might be microscopic substances floating in it.

BLM 3-17, Alternative Cleaners
2. Depending on the amount of rubbing force used and the saturation of the stains, students might say lemon juice, vinegar, or club soda removed more stains. Cooking oil removed the fewest.
3. Students should refer to the fact that some substances are soluble in certain solvents while others are not.
4. Other variables include: amount of rubbing force applied; saturation of the stains; amount of staining material used; temperature at which the activity is performed; freshness of the solvents.

BLM 3-18, Make Your Own Snow Globe
1. Boric acid is not particularly soluble in water, so most of what is put into the globe remains undissolved.
2. Students must first convert 6.23 g/mL to 62.3 g/L. They should then suggest a value between 47.2 g/L and 62.3 g/L., because it seems to be a fair assumption that the solubility of boric acid increases with temperature, given the values at 20°C and 30°C.

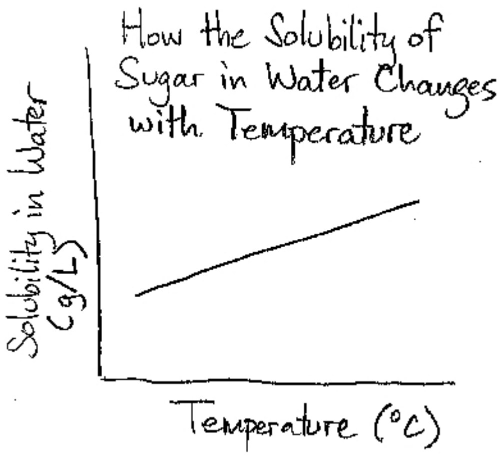
BLM 3-19, Solubility Sequencing
From most to least soluble: sugar, Epsom salts, salt, bluestone, baking soda, carbon dioxide, calcium hydroxide, oxygen, nitrogen, limestone

BLM 3-20, How Does Temperature Affect Solubility?
1. Students graphs should show a decrease of oxygen with an increase in temperature.
2. Students should suggest a value greater than 72 mg, perhaps as high as 80 mg.
3. The temperature would be between 70°C and 80°C.

BLM 3-23, Working with Concentration Units Recording Chart
Note that the answers for this BLM are found on page TR 3-24.

BLM 3-24, Chapter 8 Review
1. A
2. C
3. B
4. B
5. A

6. C
7. F
8. B
9. E
10. D
11. G
12. A
13. For example: brass, amalgam; hydrogen peroxide, vinegar; clean air or scuba tank gases
14. Suitable answers should make reference to the attraction between particles in any substance and the fact that the attractions between soluble substances enable dissolving to take place.
15. Students should say that they would continue to add salt, small measured amounts at a time, while maintaining the same temperature of the solution. If more salt dissolves, the solution is not saturated.
16. 89.6 g (Since 50 mL is one-twentieth of 1000 mL, one-twentieth of 1792 is 89.6.)
17. Quantitatively, the solubility of sugar in water is 1792 g/L at 0°C. Qualitatively, sugar dissolves readily in water so sugar is highly soluble in water.
18. Students' graph line should show an increase the amount of sugar that dissolves as temperature increases. If necessary, direct students to the data table on page 268 of their textbook so they can remind themselves of the graph they made previously. Note that the graph students draw here is intended to show the trend. Including units on the axes is not necessary.



BLM 3-25, Settling Undissolved Solids
1. Beans and flour were insoluble because they remained visible to the eye.
2. Layers formed because the beans and flour differ in density.

BLM 3-26, Growing Salt Crystals
1. The solvent evaporated and the solute was left behind.
2. A saturated solution

BLM 3-29, Simple Distillation
1. gaseous; water vapour
2. The solvent evaporates (changes to the gaseous state); the solute remains behind.
3. A condenser
4. At D, the water vapour is condensing. As it emerges at E, the substance is liquid water.

BLM 3-31, Fractional Distillation
1. Diesel oil has a higher boiling point, because it separates from the gaseous petroleum mixture lower in the tower than kerosene does.
2. Gasoline has a lower boiling point, because it separates higher in the tower than furnace oils do.
3. As the vapours rise higher in the taller tower they become cooler.

BLM 3-33, Chapter 9 Review
1. C
2. B
3. C
4. C
5. C
6. B
7. E
8. D
9. G
10. F
11. A
12. B
13. Properties enable you to recognize that the parts of a heterogeneous mixture differ in particular ways such as particle size, density, and whether or not they are magnetic.
14. The mask has holes that are small enough to prevent larger-sized sawdust and other particles from passing through it.
15. The particles that make up the solutes and solvents of homogeneous mixtures are too tiny to be trapped by the holes of most filters.
16. Students' sketches should resemble Figure 9.9 on page 283 of their textbook.
17. The different components of petroleum have different boiling points. When they are vapourized and forced to enter a tall tower where temperature will decrease with the height of the tower, each component will condense as it reaches a point in the tower that is just below its boiling point.
18. Simple distillation only separates mixtures that have two components, and petroleum is a complex mixture that has many more components.
19. The ink is not soluble in water. To get a more favourable result, a different solvent is necessary—one in which the ink will dissolve.

BLM 3-34, Unit 3 Review
1. B
2. C
3. A
4. A
5. B
6. D
7. B
8. G (or J)
9. G (or J)
10. A
11. E or G
12. K or L (assuming 9. is J)
13. H or I (assuming 8. is G)
14. C or D
15. H or I
16. E or F
17. K or L
18. C or D
19. For example: A Classification of Matter
20. Increase the temperature and decrease the particle size
21. One way is through evaporation. Another way is to let the cornstarch settle. (The question does not ask about recovery, just separation.)
22. For example: washing clothes, using a salad spinner, concentrating soup (through boiling), skimming fat off soup.
23. For example: g/L: pesticide; ppm: bottled water; %: vinegar
24. Students' sketches would show some kind of solar still that would involve draping the plastic sheet over

the bowl of ocean water. As the ocean water evaporated, the purified water vapour would condense on the overlying plastic sheet. Some kind of collecting vessels would be needed to trap the condensed liquid.