


# WEREWOLVES AND STATES OF MATTER

BY JANET SLINGERLAND  
ILLUSTRATED BY ANGEL MOSQUITO



Graphic Library is published by Capstone Press,  
151 Good Counsel Drive, P.O. Box 669, Mankato, Minnesota 56002.  
www.capstonepub.com

Copyright © 2012 by Capstone Press, a Capstone imprint. All rights reserved.  
No part of this publication may be reproduced in whole or in part, or stored in a  
retrieval system, or transmitted in any form or by any means, electronic, mechanical,  
photocopying, recording, or otherwise, without written permission of the publisher.  
For information regarding permission, write to Capstone Press, 151 Good Counsel Drive,  
P.O. Box 669, Dept. R, Mankato, Minnesota 56002.

 Books published by Capstone Press are manufactured with paper  
containing at least 10 percent post-consumer waste.

*Library of Congress Cataloging-in-Publication Data*  
Slingerland, Janet.

Werewolves and states of matter / by Janet Slingerland ; illustrated by Angel Mosquito.  
p. cm.—(Graphic library. Monster science)  
Summary: "In cartoon format, uses werewolves to explain and illustrate the science  
involved in states of matter"—Provided by publisher.

Includes bibliographical references and index.  
ISBN 978-1-4296-6578-0 (library binding)  
ISBN 978-1-4296-7333-4 (paperback)

1. Kinetic theory of matter—Comic books, strips, etc.—Juvenile literature.  
2. Matter—Constitution—Comic books, strips, etc.—Juvenile literature. 3. Graphic  
novels. I. Mosquito, Angel, ill. II. Title. III. Series.  
QC174.9.S55 2012  
530.4—dc22

2011003731

*Art Director*  
Nathan Gossman

*Designer*  
Ashlee Sulzer

*Production Specialist*  
Eric Hanstle

Printed in the United States of America in Stevens Point, Wisconsin.  
032011 006111WZF11

# TABLE OF CONTENTS

|  |    |
|--|----|
| CHAPTER 1: MATTER ALL AROUND US . . . . .                | 4  |
| CHAPTER 2: STATES OF MATTER . . . . .                    | 8  |
| CHAPTER 3: MOLECULES AND ATOMS . . . . .                 | 12 |
| CHAPTER 4: MIXTURES . . . . .                            | 18 |
| CHAPTER 5: REVERSIBLE AND IRREVERSIBLE CHANGES . . . . . | 24 |
| GLOSSARY . . . . .                                       | 30 |
| READ MORE . . . . .                                      | 31 |
| INTERNET SITES . . . . .                                 | 31 |
| INDEX . . . . .  | 32 |



Matter is all around us. Trees, water, air, the moon ...



Wherever a werewolf goes, his total mass does not change. Weight measures the pull of gravity on an object. Earth's gravity is stronger than the moon's. The werewolf weighs more on Earth than on the moon. However, his mass remains the same.



## VOLUME

The amount of space an object takes up is measured as its volume. Liquid volumes are usually measured in units like liters and quarts. Solid volumes are usually measured in units like cubic centimeters (cm<sup>3</sup>) and cubic inches (in<sup>3</sup>).



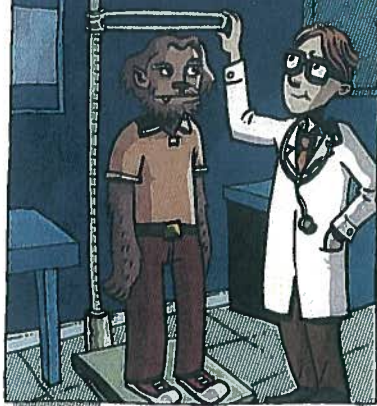
... and werewolves are all made of matter. Matter is anything that takes up space and has mass.

mass—the amount of matter in an object



gravity—a force that pulls objects together

One way to study matter is to observe its properties. Some properties can be measured, like height and weight.



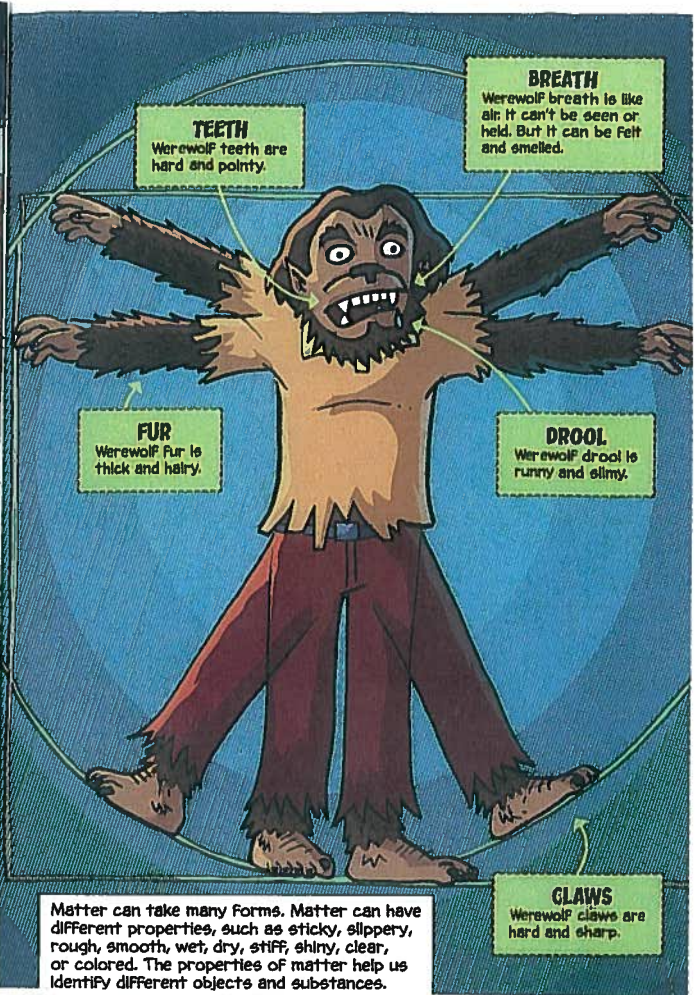
Other properties describe how matter looks or feels. Tongue depressors are flat and smooth.



A doctor's reflex hammer is hard.



A doctor's ear scope can be cold.



Matter can take many forms. Matter can have different properties, such as sticky, slippery, rough, smooth, wet, dry, stiff, shiny, clear, or colored. The properties of matter help us identify different objects and substances.

## CHAPTER 2 STATES OF MATTER

Another way to study matter is to observe its state. Most of the matter on Earth exists in one of three states: solid, liquid, or gas. All three states of matter can be found in a werewolf.



state—the form of a substance

Breath is a gas. It only holds its shape within a container. The volume of a gas can change, even inside a container.



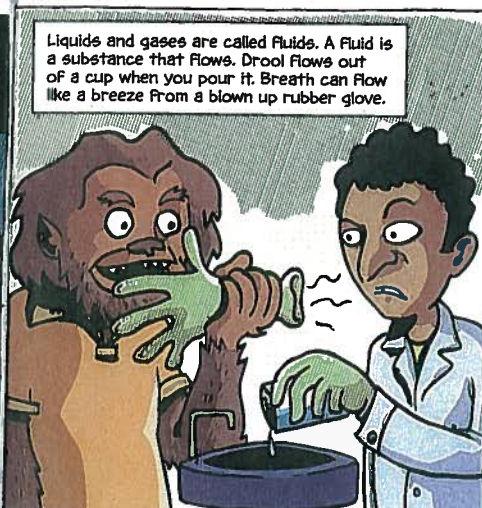
A tooth is solid. It does not easily change shape, and its volume doesn't change.



Drool is a liquid. It takes the shape of the container that holds it. Its volume doesn't change unless the werewolf drools more.



Liquids and gases are called fluids. A fluid is a substance that flows. Drool flows out of a cup when you pour it. Breath can flow like a breeze from a blown up rubber glove.



## PLASMA

A fourth state of matter is called plasma. Stars like the sun are made of plasma. It is the most common state of matter in the universe. Plasma is a gas that has been highly energized. When a fluorescent light bulb is lit, the gas inside becomes plasma.

Matter doesn't stay in one state all the time. Matter changes from one state to another depending on temperature and pressure.

The temperature at which a liquid freezes is called its freezing point. At its freezing point, liquid water turns into solid ice.

Cold water on a wet werewolf evaporates into the air:

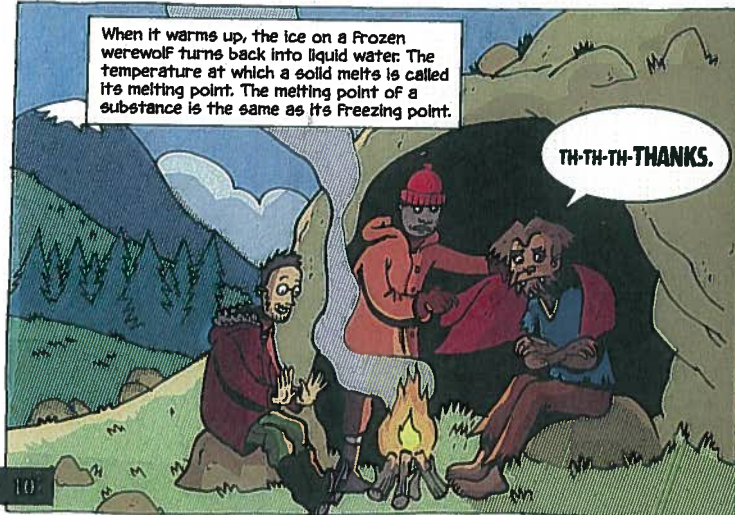
Water evaporates even faster when it reaches its boiling point. When water boils, water vapor escapes into the air as steam.



When it warms up, the ice on a frozen werewolf turns back into liquid water. The temperature at which a solid melts is called its melting point. The melting point of a substance is the same as its freezing point.

When water vapor hits a cold surface, like a cave's roof, it cools and condenses. A werewolf sitting under the roof will likely get wet.

SORRY. WE DON'T HAVE AN UMBRELLA. HAVE SOME HOT TEA INSTEAD.



### CHAPTER 3 MOLECULES AND ATOMS

All matter is made up of tiny particles called molecules. Molecules are too small to see, even under a microscope. One drop of water contains billions of molecules.

The chemical name for water is H<sub>2</sub>O. Water gets its name from the atoms in a water molecule. Each water molecule has two hydrogen atoms and one oxygen atom. Water, ice, and steam are all made up of the same water molecules.



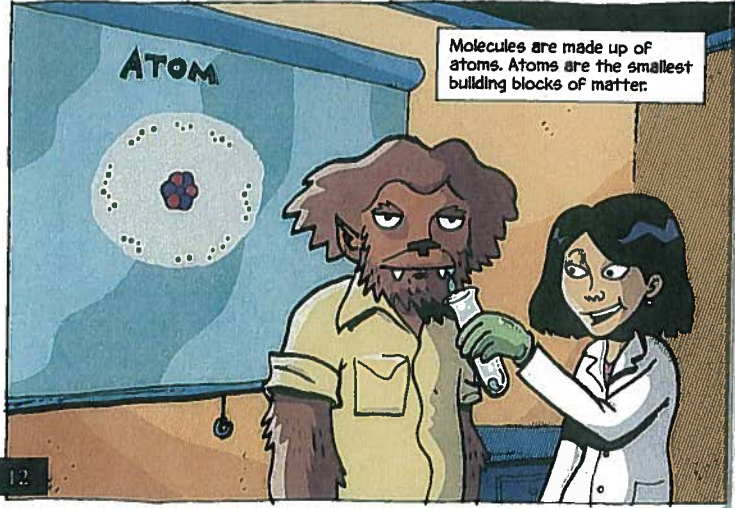
molecule - the smallest particle of a substance

### ATOM

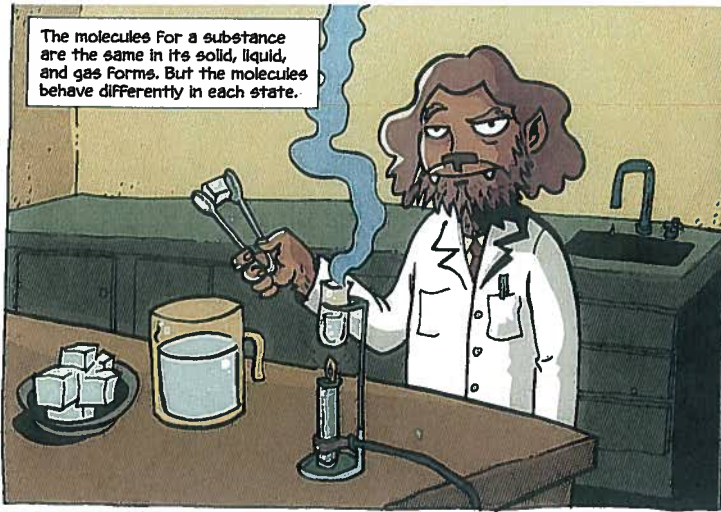
Molecules are made up of atoms. Atoms are the smallest building blocks of matter.

Different substances have different densities. For example, helium is less dense than oxygen.

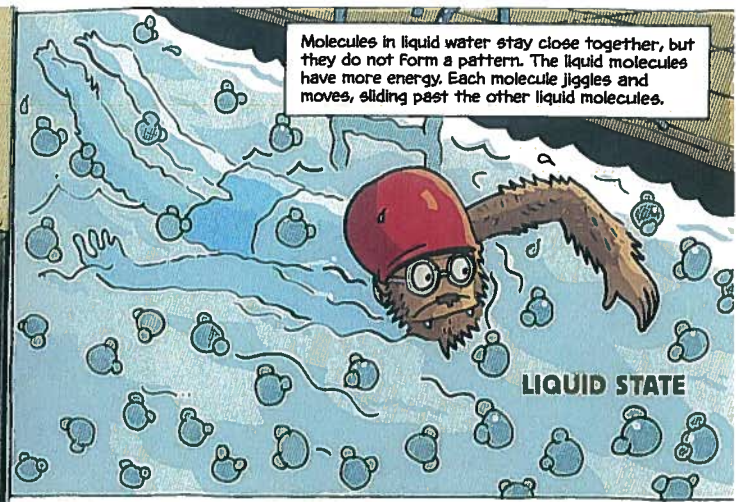
A helium balloon will float because it is less dense than the air around it. But an oxygen balloon will sink because it is more dense than the air.



The molecules for a substance are the same in its solid, liquid, and gas forms. But the molecules behave differently in each state.



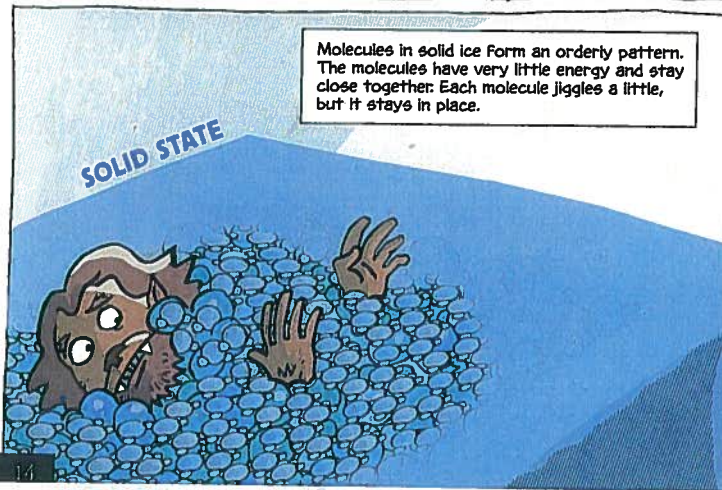
Molecules in liquid water stay close together, but they do not form a pattern. The liquid molecules have more energy. Each molecule jiggles and moves, sliding past the other liquid molecules.



**LIQUID STATE**

Molecules in solid ice form an orderly pattern. The molecules have very little energy and stay close together. Each molecule jiggles a little, but it stays in place.

**SOLID STATE**



Molecules in steam spread out rapidly. The gas molecules have a lot of energy. The molecules jiggle and zoom around. They even bounce off one another.

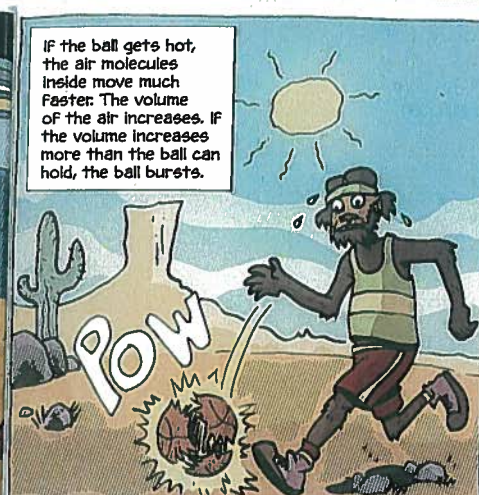


**GAS STATE**

Temperature also affects the way molecules move. At room temperature, the air molecules inside a basketball move around a lot. The ball is inflated and bounces well.



If the ball gets hot, the air molecules inside move much faster. The volume of the air increases. If the volume increases more than the ball can hold, the ball bursts.



**MELTING ROCKS**

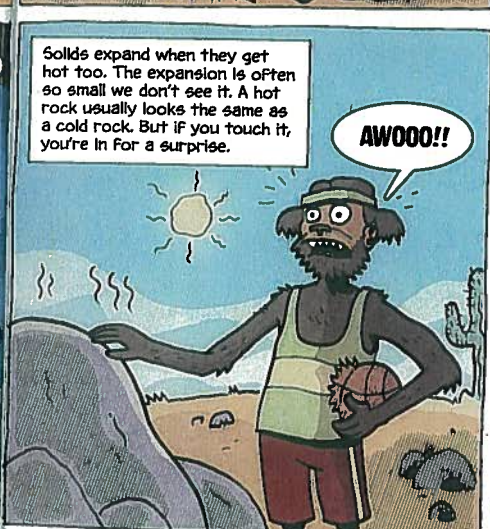
As a solid nears its melting point, the molecules jiggle faster and faster until they break free. When this happens, the solid melts into a liquid. Even rocks will melt if they reach their melting point. Lava from volcano is really melted rock.



In cold temperatures, the air molecules behave differently. They stay closer together and move more slowly. The volume of the air is less than at room temperature. The ball deflates and does not bounce well.



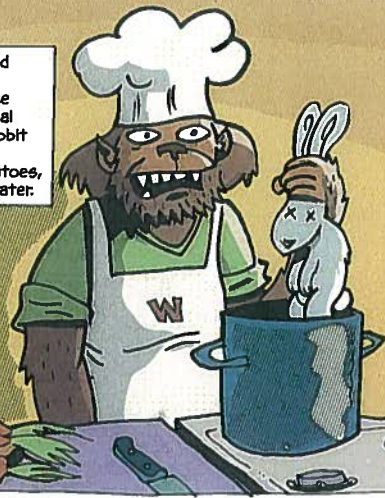
Solids expand when they get hot too. The expansion is often so small we don't see it. A hot rock usually looks the same as a cold rock. But if you touch it, you're in for a surprise.



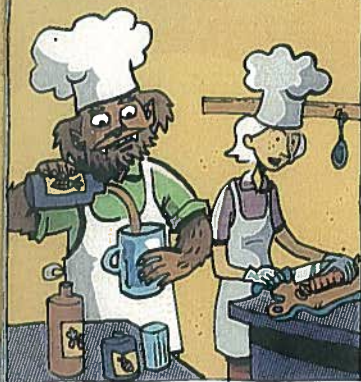
**TIME TO LEAVE!**

**CHAPTER 4 MIXTURES**

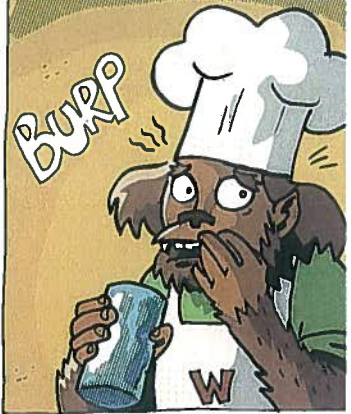
Matter can be combined to make a mixture. In a mixture, each substance keeps its unique physical properties. To make rabbit stew, a werewolf might make a mixture of potatoes, carrots, rabbits, and water.



Liquids and gases can form mixtures too. A werewolf can make Fruit punch by mixing different Fruit juices together.



Soda is a mixture of liquid water and carbon dioxide gas. The carbon dioxide gives the soda its Fizz.



You can use the physical properties of each piece to separate it from the mixture. A strainer can separate the liquids from the solids. Orange carrots look different from Furry rabbits and white potatoes.

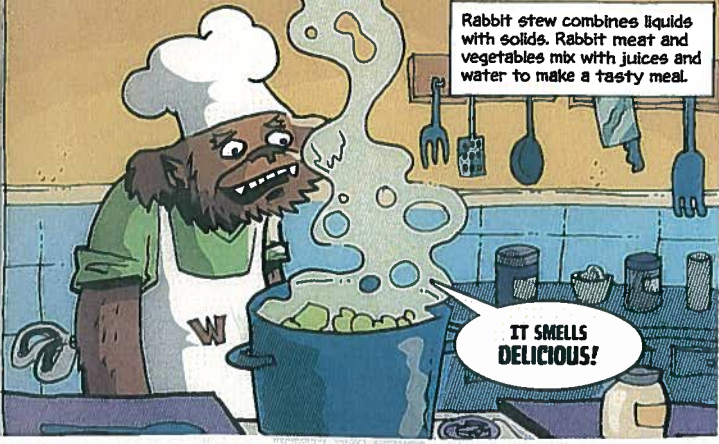
YOU CAN'T PUT A WHOLE RABBIT IN THERE!

REALLY?



Rabbit stew combines liquids with solids. Rabbit meat and vegetables mix with juices and water to make a tasty meal.

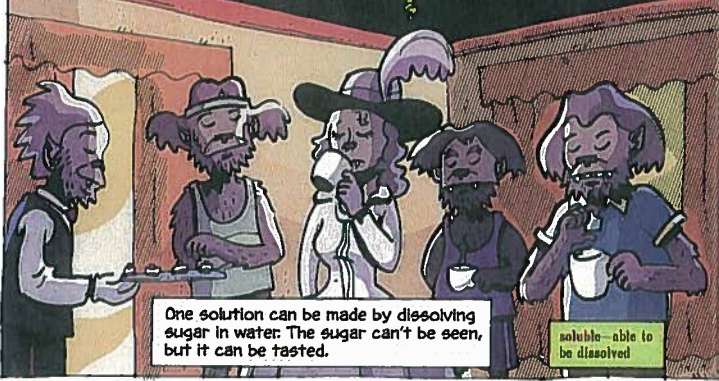
IT SMELLS DELICIOUS!



A solution is a mixture in which a soluble substance is dissolved. It may look like the dissolved substance has disappeared, but it is still there.

One solution can be made by dissolving sugar in water. The sugar can't be seen, but it can be tasted.

soluble - able to be dissolved



Small, insoluble items mixed in water make a suspension. Over time, the insoluble items settle out of the water and sink to the bottom. Crushed tea leaves form a suspension in hot water.

I PREFER A SIMPLER TEA.

suspension - a substance in which many particles are suspended



Some mixtures, such as tea, are made with insoluble items. Items that are less dense float on top. Denser items sink to the bottom.

TRY SOME OF MY SPECIAL TEA BLEND.

insoluble - not able to be dissolved

Insoluble items can be removed from a suspension using a strainer. The water passes through the strainer, but the insoluble tea leaves do not.

THIS IS TEA-RIFIC!



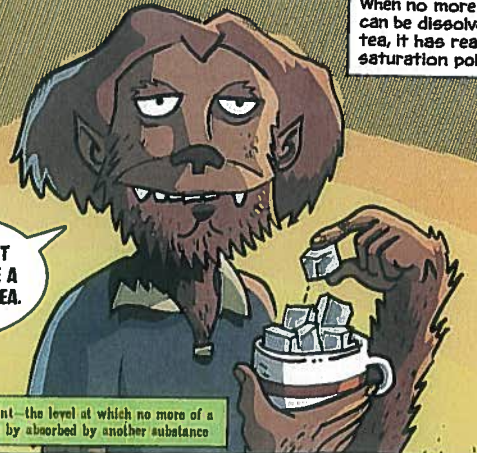
Soluble substances dissolve completely. Both salt and sugar dissolve easily in water. But don't trust a werewolf to tell the difference.



When no more sugar can be dissolved in the tea, it has reached its saturation point.

THERE'S JUST NOTHING LIKE A NICE, SWEET TEA.

saturation point—the level at which no more of a substance can be absorbed by another substance

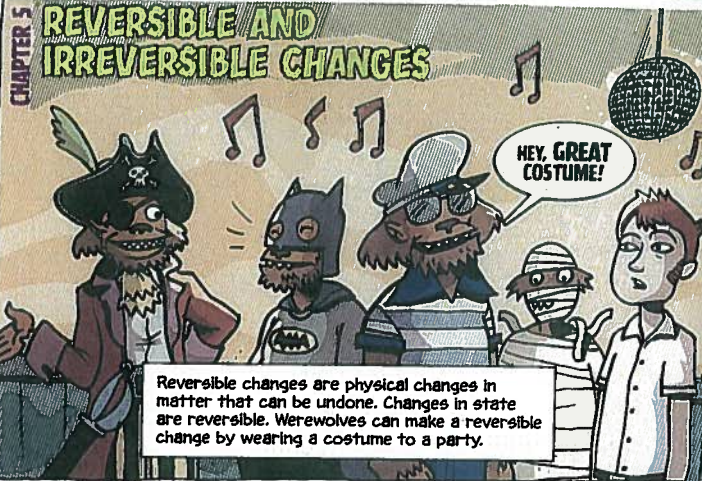


Small sugar crystals dissolve quickly in hot water. They dissolve slowly in cold water.



But they will dissolve faster if the water is stirred quickly.

If the tea is left alone and uncovered, the water evaporates and leaves the sugar behind. It makes a tasty treat for a werewolf.



### CHAPTER 5 REVERSIBLE AND IRREVERSIBLE CHANGES

Reversible changes are physical changes in matter that can be undone. Changes in state are reversible. Werewolves can make a reversible change by wearing a costume to a party.

Some changes cannot be undone. Before it is baked, cake batter is a thick, sticky liquid.



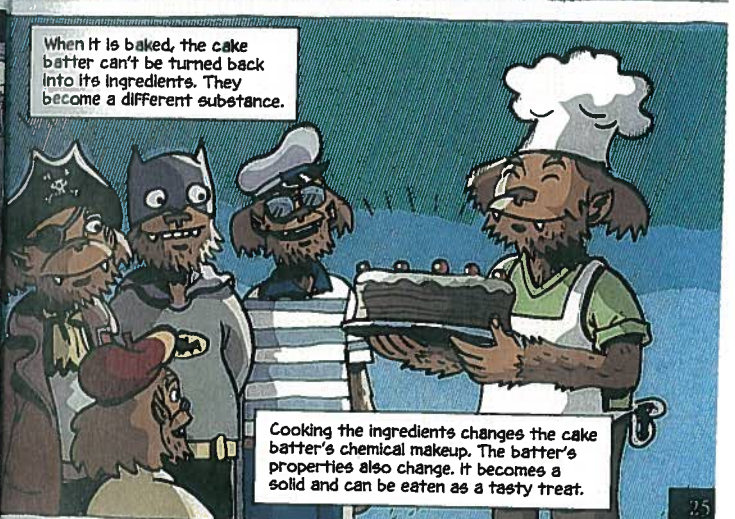
Irreversible changes are chemical changes that happen on a molecular level.



Water changes into ice when it freezes. This change is reversed when the ice melts back into water.



When it is baked, the cake batter can't be turned back into its ingredients. They become a different substance.



Cooking the ingredients changes the cake batter's chemical makeup. The batter's properties also change. It becomes a solid and can be eaten as a tasty treat.

Many substances can undergo both reversible and irreversible changes. Only the reversible changes can be undone.

STAY STILL!



When the clay is baked, it looks the same as before. But the molecules in the clay are changed.

Clay can be molded into different shapes. The moist clay is soft and undergoes reversible changes. A werewolf can change the clay's shape as often as he wants.

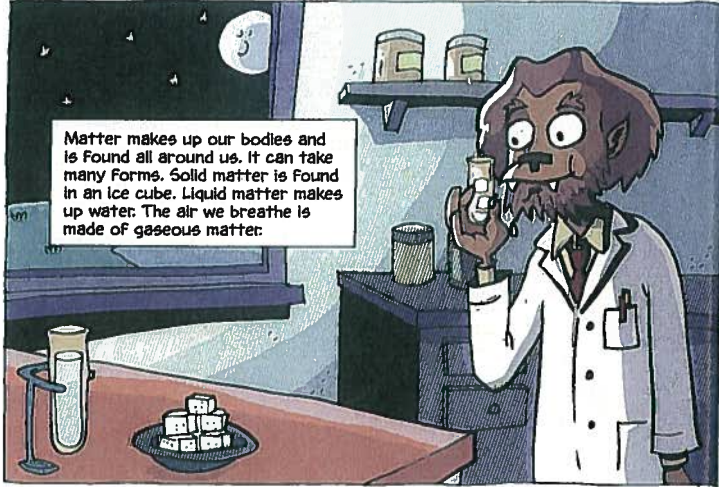


The clay has become hard, and its shape can no longer be changed.

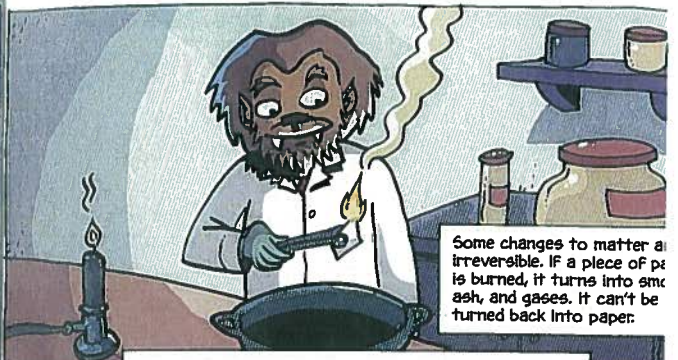
NO! I'M MORE HANDSOME THAN THAT!



Matter makes up our bodies and is found all around us. It can take many forms. Solid matter is found in an ice cube. Liquid matter makes up water. The air we breathe is made of gaseous matter.



Some changes to matter are irreversible. If a piece of paper is burned, it turns into ash and gases. It can't be turned back into paper.



But some changes to matter are reversible. Werewolves change back into human form when the sun comes up.



Matter is always changing its state. Solid ice cubes melt to make liquid water. Liquid water evaporates into a gas when heated. And water vapor turns into liquid water when it is cooled.



However, although he looks human, he is still a werewolf. When the moon is full, he will once again be a furry beast.



THANK GOODNESS! THAT FUR ITCHES!



## GLOSSARY

- condense (kuhn-DENS)—to change from a gas into a liquid
- density (DEN-si-tee)—the amount of mass an object or substance has based on a unit of volume
- evaporate (i-VA-puh-rayt)—to change from a liquid into a gas
- fluid (FLOO-id)—a liquid or gas substance that flows
- gravity (GRAV-uh-tee)—a force that pulls objects with mass together
- insoluble (in-SOL-yuh-buhl)—when a substance can not be dissolved in another substance
- mass (MASS)—the amount of material in an object
- matter (MAT-ur)—anything that has weight and takes up space
- molecule (MOL-uh-kyool)—the smallest particle of a substance that can exist and still keep the characteristics of the substance
- plasma (PLAZ-muh)—a highly charged state of matter
- saturation point (SACH-yuh-ray-shuhn POINT)—the level at which a substance can't absorb more of another substance
- soluble (SOL-yuh-buhl)—when a substance can be dissolved in another substance
- solution (suh-LOO-shuhn)—a mixture made of a substance that has been dissolved in another substance
- state (STATE)—the form a substance takes, such as solid, liquid, or gas
- suspension (suh-SPEN-shuhn)—a substance in which many particles are suspended; particles in a suspension can be separated
- volume (VOL-yuhm)—the amount of space taken up by an object or substance

## READ MORE

Biskup, Agnieszka. *The Solid Truth about States of Matter with Max Axiom, Super Scientist*. Graphic Science. Mankato, Minn.: Capstone Press, 2009.

Hurd, Will. *Changing States: Solids, Liquids, and Gases*. Do It Yourself. Chicago: Heinemann Library, 2009.

Mullins, Matt. *Super Cool Science Experiments: States of Matter*. Science Explorer. Ann Arbor, Mich.: Cherry Lake Pub., 2010.

Slade, Suzanne. *States of Matter*. The Library of Physical Science. New York: Rosen Pub. Group's PowerKids Press, 2007.

## INTERNET SITES

FactHound offers a safe, fun way to find Internet sites related to this book. All sites on FactHound have been researched by our staff.

Here's all you do:

Visit [www.facthound.com](http://www.facthound.com)



Type in this code: 9781429665780



Check out projects, games and lots more at  
[www.capstonekids.com](http://www.capstonekids.com)

## INDEX

- atoms, 12, 13
- boiling points, 11
- changing states, 10–11
- condensation, 11
- density, 13
- dissolving substances, 20, 22
- evaporation, 11, 23, 28
- fluids, 9
- freezing points, 10
- gases, 8, 9, 11, 13, 14, 15, 19, 28, 29
- gravity, 5
- irreversible changes, 25, 26, 27, 29
- liquids, 8, 9, 14, 15, 18, 19, 20, 22, 28
- mass, 4, 5
- melting points, 10, 17
- mixtures, 18–23
- molecules, 12–17
- plasma, 9
- pressure, 10
- properties of matter, 6–7, 18, 25
- reversible changes, 24, 26, 29
- saturation points, 23
- solids, 8, 10, 14, 17, 18, 19, 25, 28
- solutions, 20
- suspensions, 21
- temperature, 10, 16–17
- volume, 5, 8, 9, 16, 17
- weight, 5, 6