

**GRAPHIC  
LIBRARY**™

**ADVENTURES in**

# **SOUND**

WITH

**MAX AXIOM**™  
SUPER SCIENTIST



by Emily Sohn  
illustrated by Cynthia Martin and Anne Timmons

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

Copyright © 2007 by Capstone Press. 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.  
Printed in the United States of America

1 2 3 4 5 6 12 11 10 09 08 07

*Library of Congress Cataloging-in-Publication Data*  
Sohn, Emily.

Adventures in sound with Max Axiom, super scientist / by Emily Sohn; illustrated by Cynthia Martin and Anne Timmons.

p. cm.—(Graphic library. Graphic science)

Summary: "In graphic novel format, follows the adventures of Max Axiom as he explains the science behind sound"—Provided by publisher.

Includes bibliographical references and index.

ISBN-13: 978-0-7368-6836-5 (hardcover)

ISBN-10: 0-7368-6836-4 (hardcover)

ISBN-13: 0-7368-7889-0 (softcover pbk.)

ISBN-10: 978-0-7368-7889-0 (softcover pbk.)

1. Sound—Juvenile literature. 2. Adventure stories—Juvenile literature. I. Martin, Cynthia, 1961– ill. II. Timmons, Anne, ill. III. Title. IV. Series.  
QC225.5.S64 2007  
534—dc22

2006027995

*Art Director and Designer*  
Bob Lentz

*Cover Artist*  
Tod Smith

*Colorist*  
Michael Kelleher

*Editor*  
Christopher L. Harbo

Photo illustration credits: Scott Thoms/Capstone Press, 8 (bottom)

# TABLE OF CONTENTS



*WHAT'S THAT SOUND?* ..... 4



*MAKING SENSE OF THE WAVES* --- 12



*WHAT SOUND CAN DO* ..... 18

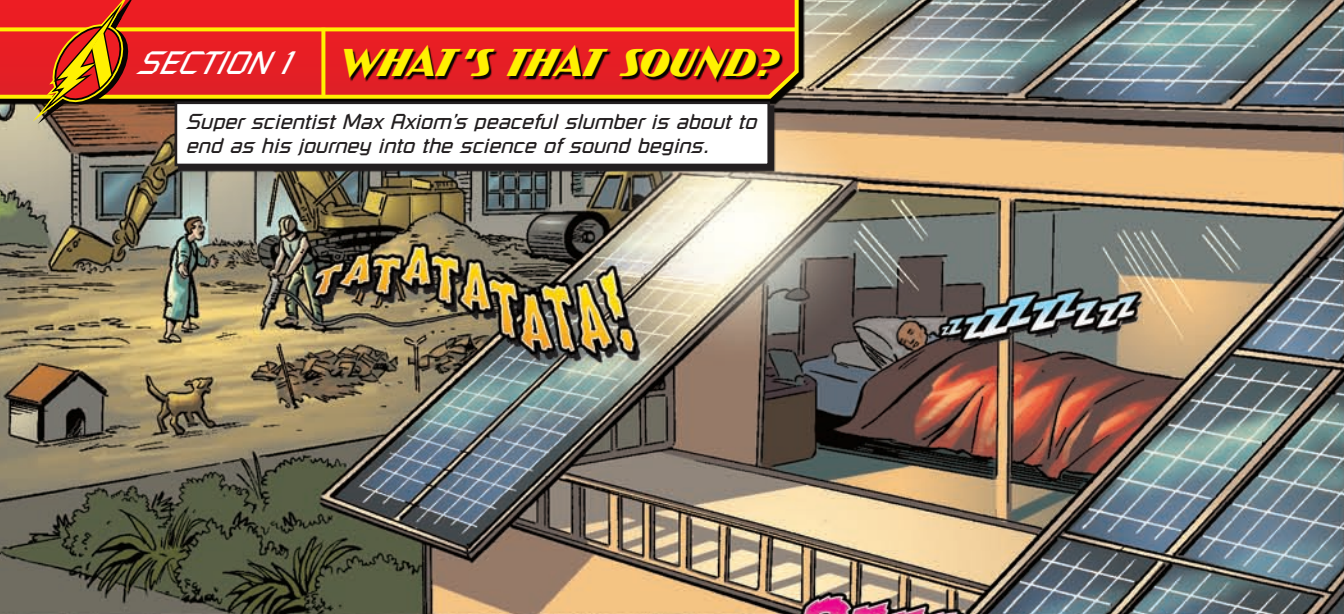


*LISTEN SAFELY* ..... 24

*More about Sound and Max Axiom*.....28–29  
*Glossary* ..... 30  
*Read More* ..... 31  
*Internet Sites* ..... 31  
*Index* ..... 32

**SECTION 1** **WHAT'S THAT SOUND?**

Super scientist Max Axiom's peaceful slumber is about to end as his journey into the science of sound begins.



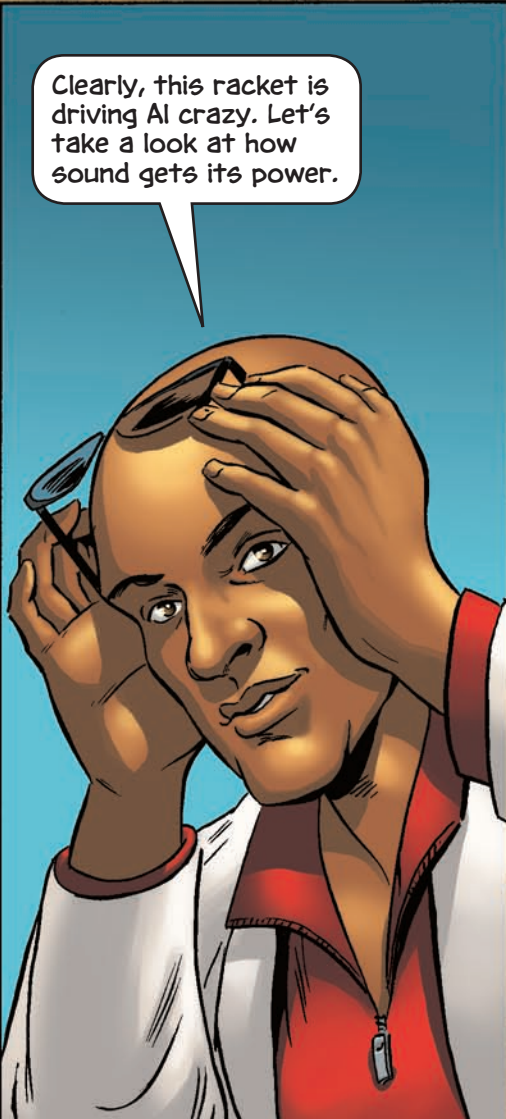


You're disturbing the peace!  
Can you hear me? You're disturbing the peace!

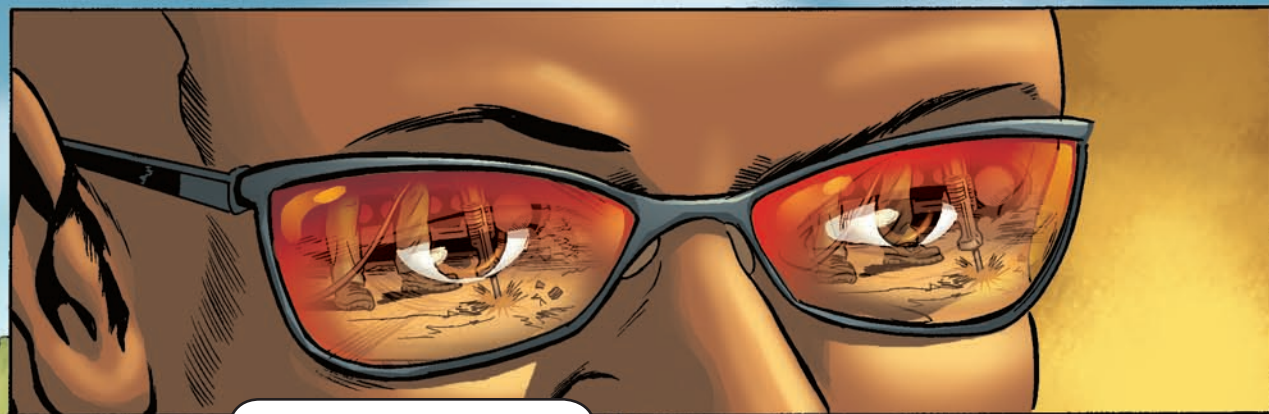


Uh, Al. I don't think he can hear you.

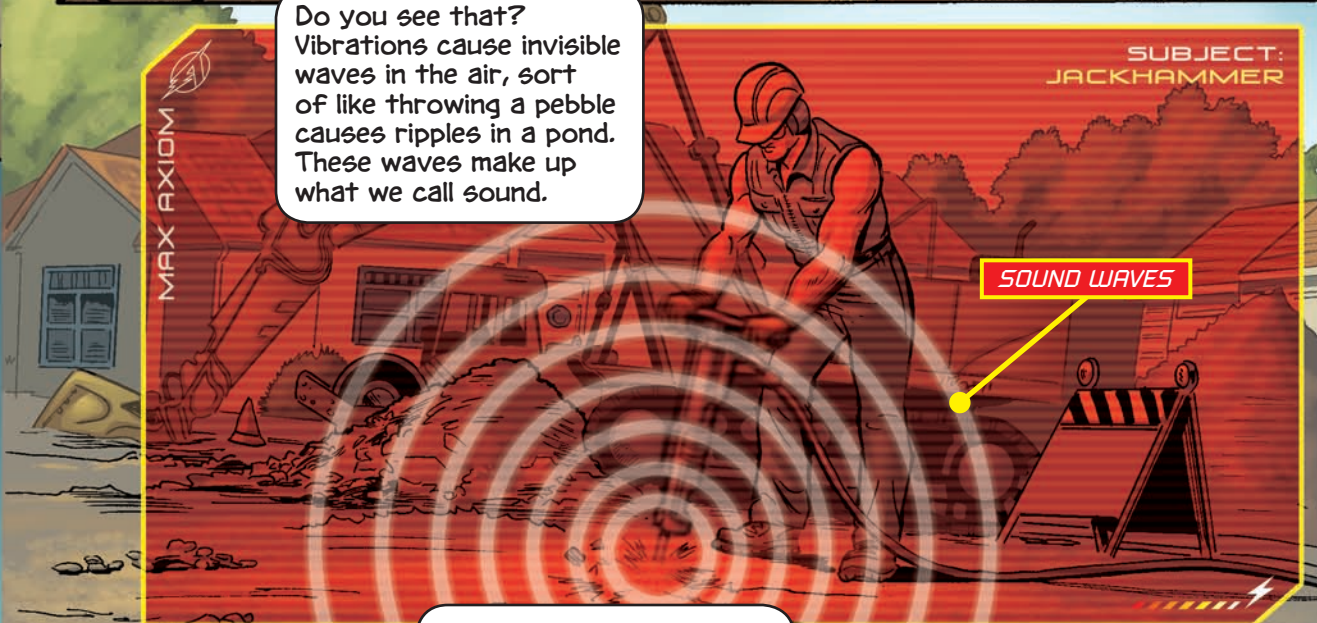
Disturbing the peace, I say!



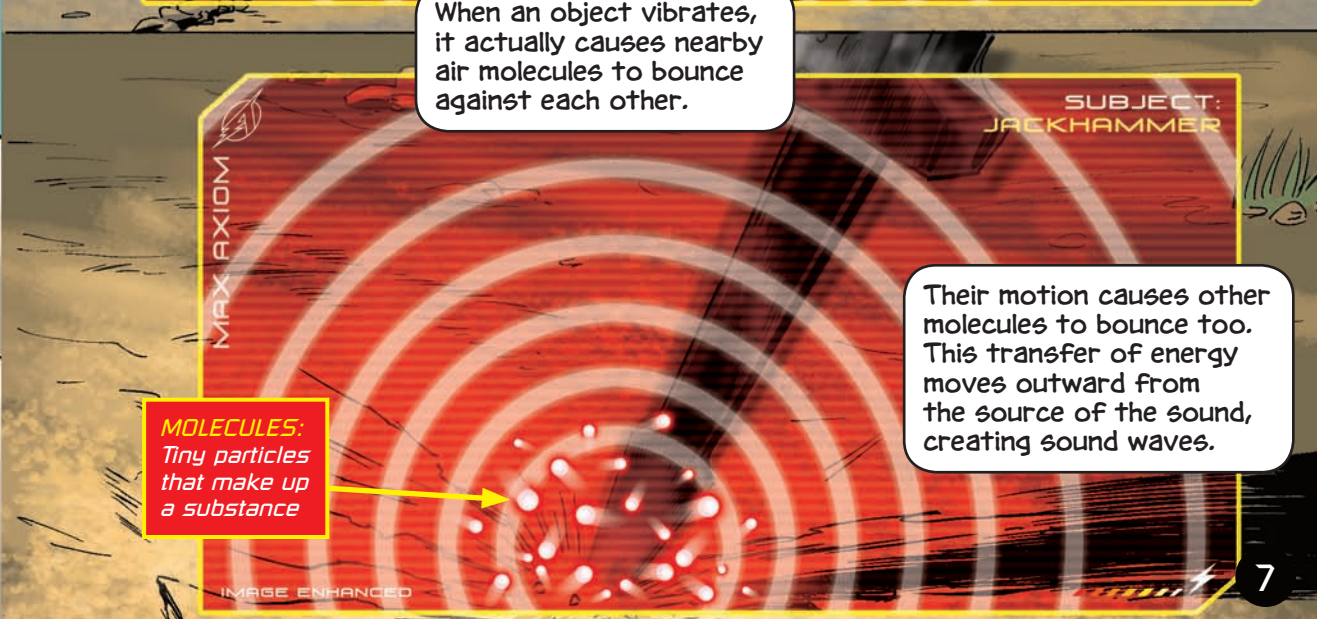
Clearly, this racket is driving Al crazy. Let's take a look at how sound gets its power.



Do you see that? Vibrations cause invisible waves in the air, sort of like throwing a pebble causes ripples in a pond. These waves make up what we call sound.



When an object vibrates, it actually causes nearby air molecules to bounce against each other.



Their motion causes other molecules to bounce too. This transfer of energy moves outward from the source of the sound, creating sound waves.

Of course, some sounds are louder than others. The difference is called intensity.

Stronger vibrations are more intense. They cause louder sounds.

Loudness is also called volume. The higher the volume, the louder the sound.

TWEET!  
TWEET!  
TWEET!

I have a job to do. Please, leave me alone.

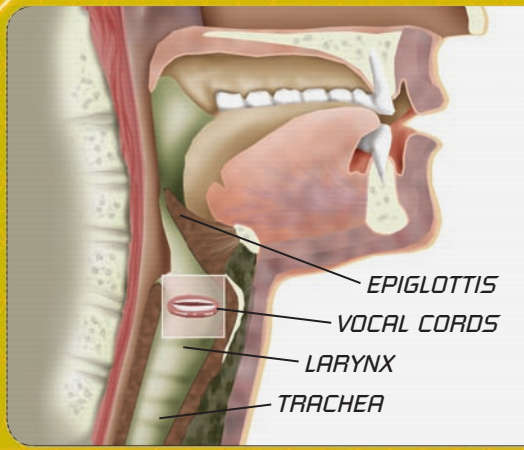
PUTT  
PUTT  
PUTT  
PUTT

Distance affects volume, too. Sound waves lose energy as they travel. So, the farther away I get, the quieter the jackhammer sounds to me.

Ahh. Much better.

TWEET!  
TWEET!

**THE HUMAN LARYNX** ACCESS GRANTED: MAX AXIOM



Inside your throat, your larynx allows you to talk, sing, and make other noises. Inside the larynx, two muscles called vocal cords squeeze together and vibrate as air passes by them. The faster they vibrate, the higher your voice sounds. Your tongue and lips shape the sounds you make.

Sound involves more than just volume. This bird's song gets louder and softer, but it is also full of notes, some higher than others.



The bird may not know it, but the secrets behind its lovely melody are called frequency and pitch.

Frequency equals the number of sound waves that pass a point during a certain amount of time.



For instance, right now only one sound wave passes by me each second. Therefore, the sound has a frequency of 1 hertz (Hz).

But if 50 waves pass by me in one second, the sound has 50 Hz. Faster vibrations create sounds with higher frequencies.



The frequency of a sound determines its pitch.



Something with lots of Hz sounds higher than something with fewer Hz.

But people can't hear everything. In fact, we can only hear frequencies between 20 and 20,000 Hz.

Sounds below 20 Hz are called infrasound. Sounds above 20,000 Hz are called ultrasound.



**CHECK THIS OUT:**

Dogs hear some sounds with frequencies up to 40,000 Hz. That explains why your dog might howl for no apparent reason. Dogs hear things we don't even know are there.

# MORE ABOUT SOUND

- ⚡ Sound travels faster through solids than through gases and liquids. Why? Because the molecules in solids are packed closer together. The closer the molecules, the faster the sound waves travel from one molecule to the next. A sound travels 770 miles (1,239 kilometers) per hour through air. It speeds through steel at about 11,630 miles (18,716 kilometers) per hour.
- ⚡ Most bats use echolocation to hunt. As they fly, bats release high-pitched sounds that bounce off objects all around them. Based on the echoes they hear, the bats can locate and determine the size of insects fluttering nearby.
- ⚡ The hammer, anvil, and stirrup are the smallest bones in the human body. They are the same size now as they were the day you were born. All together, they could fit on a penny.
- ⚡ Ear wax helps keep your ears clean. As wax forms inside the ear canal, it clings to dirt particles. Eventually, the wax works its way out of the ear, carrying the dirt along with it.
- ⚡ The liquid in the cochlea does more than just magnify vibrations. It also plays a role in balance and helps your body know what is up and what is down.
- ⚡ Elephants use infrasound, or sound below the range of human hearing, to talk to each other. They can use rumbling sounds as low as 5 Hz to communicate.

- ⚡ A cricket's hearing organs are located just below the knees of its front legs. A cicada's hearing organ is on its abdomen.
- ⚡ Scientists measure the loudness, or volume, of sounds in decibels (dB). A whisper measures about 20 dB, while normal talking is 60 dB. A jet measures about 120 dB and a firecracker exploding is about 140 dB. Any sound above 85 dB can cause hearing damage if listened to for too long. At close range, noise levels above 140 dB cause immediate hearing damage.
- ⚡ Blue whales are the loudest animals on earth. Their calls have measured 188 dB and can be heard from hundreds of miles away.

## MORE ABOUT

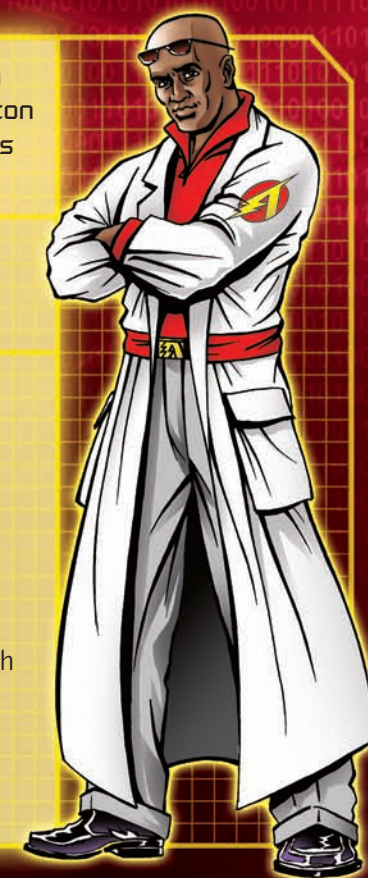
**MAX AXIOM**  
SUPER SCIENTIST

**Real name:** Maxwell J. Axiom  
**Hometown:** Seattle, Washington  
**Height:** 6' 1"    **Weight:** 192 lbs  
**Eyes:** Brown    **Hair:** None

**Super capabilities:** Super intelligence; able to shrink to the size of an atom; sunglasses give x-ray vision; lab coat allows for travel through time and space.

**Origin:** Since birth, Max Axiom seemed destined for greatness. His mother, a marine biologist, taught her son about the mysteries of the sea. His father, a nuclear physicist and volunteer park ranger, schooled Max on the wonders of earth and sky.

One day on a wilderness hike, a megacharged lightning bolt struck Max with blinding fury. When he awoke, Max discovered a newfound energy and set out to learn as much about science as possible. He traveled the globe earning degrees in every aspect of the field. Upon his return, he was ready to share his knowledge and new identity with the world. He had become Max Axiom, Super Scientist.



## GLOSSARY

**absorb** (ab-ZORB)—to soak up

**cochlea** (KOH-klee-uh)—a spiral-shaped part of the ear that helps send sound messages to the brain

**decibel** (DESS-uh-bel)—a unit for measuring the volume of sounds

**eardrum** (IHR-druhm)—a thin piece of skin stretched tight like a drum inside the ear; the eardrum vibrates when sound waves strike it.

**echolocation** (eh-koh-loh-KAY-shuhn)—the process of using sounds and echoes to locate objects; bats use echolocation to find food.

**energy** (EN-ur-jee)—the ability to do work, such as moving things or giving heat or light

**frequency** (FREE-kwuhn-see)—the number of sound waves that pass a location in a certain amount of time

**hertz** (HURTS)—a unit for measuring the frequency of sound wave vibrations; one hertz equals one sound wave per second.

**molecule** (MOL-uh-kyool)—two or more atoms of the same or different elements that have bonded; a molecule is the smallest part of a compound that can be divided without a chemical change.

**pitch** (PICH)—the highness or lowness of a sound; low pitches have low frequencies and high pitches have high frequencies.

**reflect** (ri-FLEKT)—to bounce off an object

**refract** (ri-FRACT)—to bend when passing through a material at an angle

**vibration** (vye-BRAY-shuhn)—a fast movement back and forth

## READ MORE

**Bayrock, Fiona.** *Sound: A Question and Answer Book.* Questions and Answers: Physical Science. Mankato, Minn.: Capstone Press, 2006.

**Cooper, Christopher.** *Sound: From Whisper to Rock Band.* Science Answers. Chicago: Heinemann, 2004.

**Dreier, David Louis.** *Sound.* Science around Us. Chanhassen, Minn.: Child's World, 2005.

**Parker, Steve.** *Making Waves: Sound.* Everyday Science. Chicago: Heinemann, 2005.

**Trumbauer, Lisa.** *All about Sound.* Rookie Read-About Science. New York: Children's Press, 2004.

## INTERNET SITES

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

Here's how:

1. Visit [www.facthound.com](http://www.facthound.com)
2. Choose your grade level.
3. Type in this book ID **0736868364** for age-appropriate sites. You may also browse subjects by clicking on letters, or by clicking on pictures and words.
4. Click on the **Fetch It** button.

FactHound will fetch the best sites for you!





# ***INDEX***

- absorbing sound, 19
- animals, 10, 11, 16, 22–23, 28, 29
- audiologists, 24
  
- decibels, 29
  
- earplugs, 26
- ears, 12–13, 19, 23, 24–26, 27, 28
  - anvil, 13, 28
  - cochlea, 13, 28
  - eardrum, 13
  - hair cells, 13, 25, 26
  - hammer, 13, 28
  - stirrup, 13, 28
- echoes, 19, 28
- echolocation, 22, 28
- energy, 7, 9
  
- frequency, 10–11
  
- hearing, 4, 11, 12–13, 16, 17, 28, 29
  - and damage, 24–26
- hearing aids, 26
- hertz, 10, 11
  
- infrasound, 11, 28
- intensity, 8
  
- larynx, 8
  
- molecules, 7, 28
  
- notes, 10
  
- outer space, 17
  
- pitch, 10, 11, 28
  
- reflecting sound, 19, 21
- refracting sound, 20
  
- safety, 24–26
- sonar, 21–22
- sonic booms, 15
- sound waves, 7, 9, 10, 12, 15, 16, 17, 20, 21, 22, 28
- speed, 14–15, 16, 28
  
- ultrasound, 11
  
- vibrations, 7, 8, 10, 13, 17, 28
- vocal cords, 8
- volume, 8, 9, 10, 25, 26, 29