



LISTEN UP

Kids can suffer **permanent hearing damage** from prolonged exposure to loud sound.

FREE
SCIENCE
COMICS &
DIAGRAMS



HOW “**LOUD**” IS TOO “**LOUD**,”?

Lessons on the Science of
Sound + Protecting Your Hearing

GRADES 3–6

The Science of Sound

Explore the ear, experiment with sound waves, and teach students ways to protect their hearing.

Objective

Students will create a model to demonstrate how sound waves are transmitted.

Standards

NGSS

MS-PS4-2 Model sound waves

CCSS-ELA

3-6: RI.3.4 Determine meaning of domain-specific terminology

3-6: RI.3.7 Use information from illustrations to demonstrate understanding

Time

90 minutes

Materials

- Follow the Sound Waves activity sheet
- Sort the Sounds activity sheet
- Bowls, plastic wrap, and rubber bands
- Cake sprinkles (uncooked rice and salt also work well)

ANSWER KEYS

Follow the Sound Waves

1. outer ear, sound waves; 2. ear canal; 3. eardrum, vibrations; 4. middle ear, bones; 5. inner ear, cilia; 6. nerve, brain.

Sort the Sounds

• Safe Zone

Whisper: 30 dB; Normal conversation: 60 dB.

• Caution Zone

Movie theater: 74–104 dB; School cafeteria: 85 dB; Lawn mower: 80–100 dB; Motorcycle: 80–110 dB.

• Danger Zone

Headphones at high volume and Concert: 94–110 dB; Ambulance siren: 110–129 dB; Jet taking off: 140 dB; Fireworks: 140–160 dB.

1 Have students close their eyes, then click a pen, shut a drawer, use a stapler. Ask them to guess the sounds. Then ask how they are able to *hear* the sounds. **Answer:** Sound is traveling from its source through the air to their ears in sound waves.

2 **Distribute** one bowl, a piece of plastic wrap, and a pinch of sprinkles to groups of students. Have groups stretch the plastic wrap very tightly over the bowl like a drum, using a rubber band to secure if necessary, and add a pinch of sprinkles to the surface of the plastic wrap.

3 Have students **take turns** bringing their lips close to the edge of the bowl (but not touching it). Experiment by having them hum loudly and quietly (amplitude) and at different pitches (frequency). What do they observe? **Answer:** These models demonstrate how sound waves travel by disrupting the air and creating vibrations (the sprinkles help us see the vibrations).

4 **Draw** NGSS connections by reviewing that we perceive amplitude as volume and frequency as pitch by asking questions such as:

- If a sound is very loud, how would you expect the waveform to look? (High amplitude; wave has tall peaks.)
- If a sound has a high pitch, what would you expect to see? (High frequency; crests of waveforms are close together.) What about a low frequency? (Crests of waveforms are farther apart.)

5 Have students **read** the *How Loud Is Too Loud?* comic book (produced by the Centers for Disease Control and Prevention) and complete the Follow the Sound Waves sheet. Have younger students work in groups or as a class.

6 **Distribute** the Sort the Sounds sheet. Have students work in pairs to order the sounds from quietest to loudest. Reveal the correct order of the sounds. Then ask students to guess which sounds fall into the safe, caution, and danger zones. Reveal the correct zones.

7 **Wrap up** by asking students which potentially harmful sounds they encounter often (e.g., music through their headphones, loud video games, movie theater, etc.). Ask: *What are some ways you can protect your hearing?* (Prompt for: take regular breaks from headphones, turn down the volume, etc.). Then ask: *Why is it important to protect your hearing?*

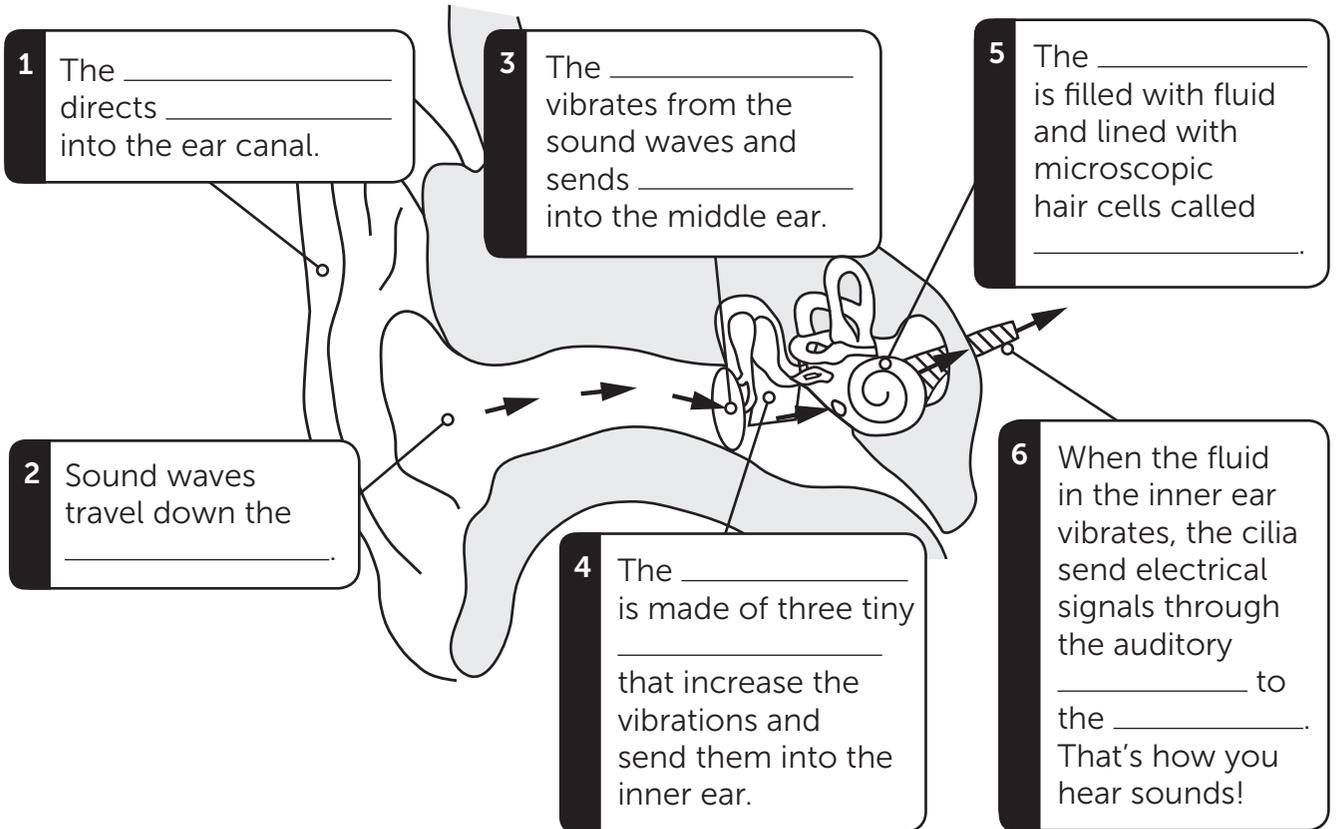
EXTENSION

Have students use the engineering design process to identify and address a noise-based problem in their classroom. Can they add absorbent materials to muffle a too-loud sound or come up with another solution?

Name _____

Follow the Sound Waves

Read the *How Loud Is Too Loud?* comic book and take a journey through the ear. Fill in the blanks using word bank terms as you go.



WORD BANK

nerve
sound waves
brain

inner ear
vibrations
eardrum

bones
outer ear
ear canal

middle ear
cilia

Write one or two sentences to explain how sound travels through your ear.

Sort the Sounds

- 1 Cut along the dotted lines. Then put the sounds in order from the quietest to the loudest.
- 2 Sort each sound underneath the correct sound zones.
- 3 When you're finished, read and sign your hearing pledge bookmark.

Cut this bookmark out!



ZONES		
SAFE	CAUTION	DANGER
These sounds won't damage my hearing.	These sounds for long periods of time can damage my hearing.	These sounds for a short period of time can damage my hearing.
SOUNDS		
Whisper	Fireworks	School cafeteria
Jet taking off	Concert	Motorcycle
Lawn mower	Sporting event	Headphones at high volume
Ambulance siren	Normal conversation	Movie theater

I will take care of my hearing!

I pledge to:

 **TURN IT DOWN**

If you can't hear the person next to you talking as you're listening to music—turn down the volume!

 **PROTECT MY EARS**

Attending a concert or a sporting event? Remind your parents to bring along earplugs to protect your family from loud sounds.

 **WALK AWAY**

Creating distance between you and a loud noise is one of the easiest ways to protect your hearing!

Your Signature