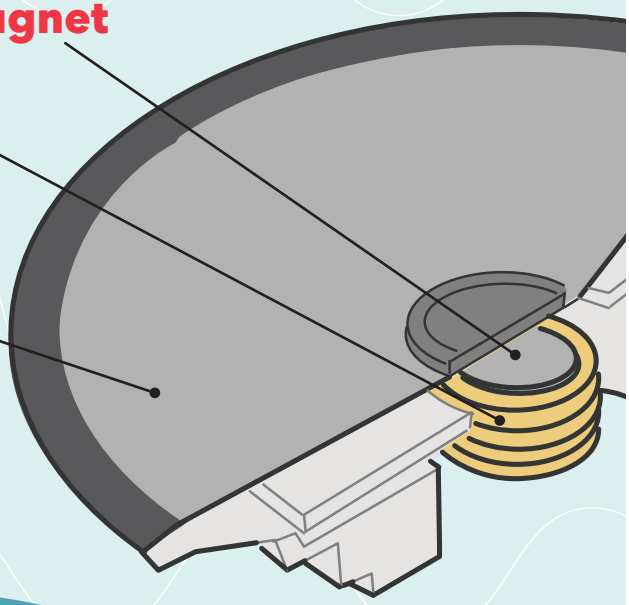
PUTTING SCIENCE TO WORK

ELECTRICITY TO SOUND

The speaker drivers inside a pair of headphones can do something amazing — **turn electricity into sound**!

Machines like these, that change electrical energy into sound energy (and vice-versa), are called *electroacoustic transducers*.

Remember, your speaker drivers each contain a fixed **magnet** surrounded by a **coil of wire**. The coil of wire is attached to a thin plastic membrane, called a **speaker cone**.



SOUND RECORDING

Microphones work the same way as speakers, but in reverse. The sound of your voice vibrates a membrane inside the mic, which moves a coil of wire to make an electrical pattern!

photo by smolaw / shuttershock.com

Every sound recording is made up of a pattern of electrical signals. When you play a song or a sound, that electrical pattern travels from your device, through the cord, and into the speaker.

1. The electrical pattern flows through the **coil of wire**. This creates a changing magnetic field, where the changes in the field follow the same pattern as the electrical signal.

2. This changing magnetic field interacts with the fixed **magnet** *(just like how fridge magnets push and pull on each other)*. The **coil of wire** gets pushed and pulled by the fixed magnet as the field changes.

3. This in-and-out motion follows the same pattern as the electrical signal. And as the **coil** moves, so does the **speaker cone** *(since they're attached)*.

4. As the **speaker cone** moves in and out, it pushes on the air around the speaker to make waves. The sound waves travel through the air in every direction, like ripples on a pond.

When the sound waves reach your ear, they make your eardrum *(another membrane!)* vibrate in that same pattern. That sends an electrical signal to your brain through your nerves, telling you what you're hearing. In other words, your ears turn sound back into electricity. That means they're electroacoustic transducers, too!

DESIGN CHALLENGE

AMP IT UP

Can you turn up the volume with no electricity? Design and test your own amplification device to bump up the sound from a phone!

You'll need...

- a phone (or other song-playing device)
- stuff from your recycling bin
- scissors or a craft knife
- tape or glue

Design questions:

1. For amplification, the sound needs to bounce around, like in an echo-y room. What materials can you find that will reflect the sound, not absorb it?

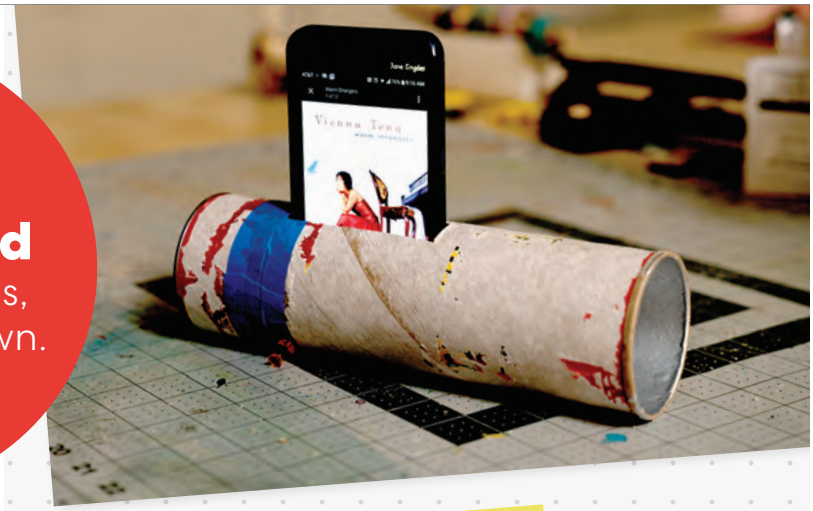
2. How will you direct the sound? Think about the shape of a trumpet, or a bullhorn.

3. Music is personal, so your no-electricity amp should be, too. Simple or fancy, punk or pop — what's the visual vibe you're going for?

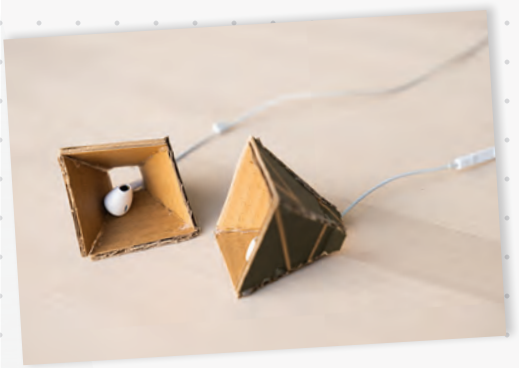
Old hearing aids are a good source of inspiration. This fan hearing aid was meant to be held behind the ear like you might hold your hand if you were saying, "Eh? Speak up! I can't hear you."

Held to the ear, an ear trumpet like this one makes it easier to hear a quiet conversation. Give it a try with a kitchen funnel!

Get inspired
by these designs, or invent your own.



Pop the ends off a potato chip can.



Try trumpets for earbuds.

Show off what you made!

Use **#EurekaCrate** to get featured!

Recycle a favorite magazine.

Just a bowl will work, too!

bowl by iMoved Studio /shutterstock.com