

# MUSIC TO MY EARS ADVENTURE JOURNAL

TAKING ON THE  
WORLD, ONE  
ENGINEERING  
CHALLENGE AT A TIME

PROPERTY OF THE FUTURE ENGINEER, \_\_\_\_\_

## Music to My Ears



Hello, GEERlings! It's Flynn again! I'm still in Nigeria with my parents where they're working to help solve the problem of deforestation. We've been staying in a part of Nigeria where the Igbo people live and learning a lot about Igbo culture.

Soon the Igbo will celebrate the New Yam Festival, and some of my friends are going to perform a song and dance as part of the celebration. They asked me to join in and play a musical instrument during their performance, and I really want to, but I don't have an instrument to play!

Maybe you can help me create an instrument! Are you ready to get your gears moving? Check out the videos I posted to find out more!

Good luck,

Flynn

# Pre Quest Setup

## Music to My Ears



This quest requires at least 10 feet of space so that you can perform the Test for Success. The test for success requires four people to work together, so if you're working on your own, try to get some friends or family members to help you out!

If that is not possible, there are other options to complete the Test for Success as well.

Good luck!

# Instructions for GEERlings

## Segment 1— Music to My Ears



Here are the materials I gathered from my parents' office and from around the village.

The Supply Sack has materials that represent the objects Flynn has with her. She found these objects around the village and in her home. Here's what you

have to work with:

### Material:

### What it Represents:

2 plastic cups	⇒	From recycling bin
2 Styrofoam cups	⇒	Dried, hollowed gourds
1 cardboard tube	⇒	Reed
2 empty aluminum cans	⇒	From recycling bin
3 sheets construction paper	⇒	Banana leaves
2 sheets paperboard	⇒	Tree bark
5 rubber bands	⇒	From parents' office
2 wooden pencils	⇒	Twigs
Masking tape	⇒	From parents' office

You can use scissors to make changes to these materials in any way you need to. Make sure you plan ahead and use the materials wisely; there are no extras!



Yams stay good for up to 6 months without needing to be refrigerated. No wonder they're such an important part of Nigerian society!

# Your Challenge

## Segment 1—Music to My Ears



Flynn needs to create a musical instrument to play at the New Yam Festival. The instrument must play a melody, and it needs to be heard over the sound of two drummers.

The materials in the Supply Sack are the only materials you have to work with. Use your creativity and your engineering intuition to make a brand-new, never-seen-before instrument! Before you start working, use the space below to plan out your solution.

My solution will look like this, and I will use these materials:

- Plastic cups
- Styrofoam cups
- Cardboard tube
- Aluminum cans
- Construction paper
- Paperboard
- Rubber bands
- Wooden pencils
- Tape

# Initial Test for Success

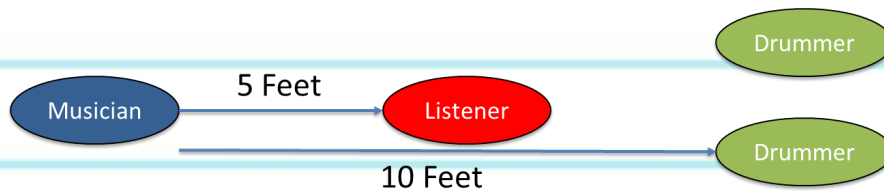
## Music to My Ears



It's the moment of truth! Check to make sure your instrument meets the requirements and use these directions to conduct the test.

### Hearing Test with Four People

You will need 4 people for the test—1 musician, 1 listener, 2 drummers. Position the 4 people according to the diagram below. Use a measuring tape to accurately measure out the distances.



To start the test, the listener must turn their back to the musician so that they cannot see the instrument. The drummers will begin clapping rhythmically, not stopping until the test is finished. The musician will play the instrument 3 times, pausing after each time they play. If the listener hears the instrument, they raise their hand.

### Hearing Test with Two People

One person will be the musician and one person will be the listener. Use a stereo, computer, or other device to play drum sounds or a song with heavy drums. The listener must turn their back to the musician so that they cannot see the instrument. The musician will play the instrument 3 times, pausing after each time they play. If the listener hears the instrument, they raise their hand.

### Requirements

1. Instrument must play a melody.
2. Listener must hear the instrument all 3 times it is played.

# Let's Engineer It!

## Segment 2—Music to My Ears



Flynn needs to create a musical instrument for the upcoming festival, and her engineering intuition is telling her that she needs to think about how sound waves are affected by the shape and material of her instrument.

You can use the resource links online to find out more about sound waves.

The Igbo people have their own traditional calendar. It has 4 days in a week, 7 weeks in a month, and 13 months in a year.



These questions will help guide you while you research sound waves. Take notes on the videos you watch and websites you read. The notes should be in your own words; don't copy down any information unless you understand it well enough to explain it to a friend. You can also draw pictures about the things you learn.

1. What is a wave?

2. What are sound waves?



3. What causes sound waves? Give some examples of ways to make sound.

4. How do we hear sounds?



5. If sound waves are weak, how do they sound to us? How do they sound if they are strong?



6. What can happen to sound waves when they run into an object?



7. What materials absorb sound waves well?

8. What materials reflect sound waves well?



9. What materials transmit sound waves well?

10. What materials are commonly used in musical instruments? Why do you think they are used so often?

11. Why is a horn shape useful for making sounds louder?



Now that you've researched and learned more about sound waves, think about how you can use this information to design a musical instrument. What materials will you use? What shapes? How will it all fit together? Draw a picture to help you plan what you will build.



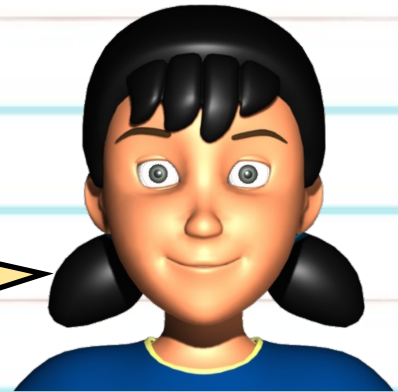
# Let's Put It All Together!

## Segment 3—Music to My Ears



It's time to put your new knowledge about sound waves to use! You will design and build a musical instrument for Flynn to play at the New Yam Festival. Your instrument will be successful if it plays a melody and can be heard over the sound of 4 drums.

Think about what you built in the first session. What worked well? What didn't? Draw a picture to help you plan your design. Label the picture to show how you will use the different materials from the supply sack.



I can make the musical instrument like this, using these materials:

- Plastic cups
- Styrofoam cups
- Cardboard tube
- Aluminum cans
- Construction paper
- Paperboard
- Rubber bands
- Wooden pencils
- Tape

# Post Rebuild Test for Success

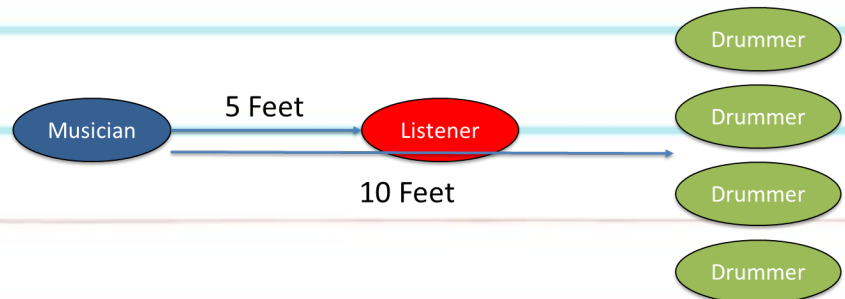
## Music to My Ears



It's the moment of truth! Check to make sure your instrument meets the requirements and use these directions to conduct the test.

### Hearing test

You will need 6 people for the test—1 musician, 1 listener, 4 drummers. Position the 6 people according to the diagram below. Use a measuring tape to accurately measure out the distances.



To start the test, the listener must turn their back to the musician so that they cannot see the instrument. The drummers will begin clapping rhythmically, not stopping until the test is finished. The musician will play the instrument 3 times, pausing after each time they play. If the listener hears the instrument, they raise their hand.

### Hearing Test with Two People

One person will be the musician and one person will be the listener. Use a stereo, computer, or other device to play drum sounds or a song with heavy drums. For the segment 2 test, you will need to turn the volume up to mimic adding more drummers to the test. All the other requirements are the same.

### Requirements

1. Instrument must play a melody.
2. Listener must hear the instrument all 3 times it is played.

# GEERling Vocabulary List

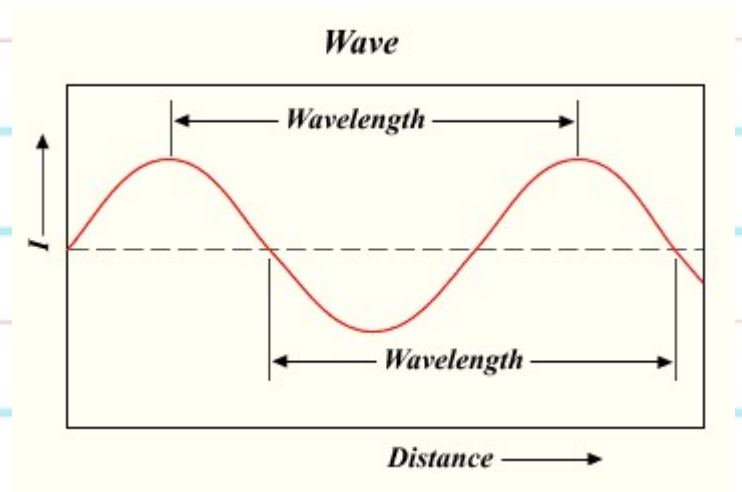
## Music to My Ears



In Igbo culture, yams are sometimes referred to as the "king of crops" because it is a reliable food source and can be eaten in many different ways.



**Wave:** a disturbance or vibration that transfers energy through matter or space but does not transfer any matter. Sound waves are vibrations that travel through solids, liquids, and gases. When they transfer energy to our ear drums, we hear sound.



**Absorb:** to take in without giving anything back. When a material absorbs sound waves, some of the sound "disappears" because the energy in the wave changes to heat energy.



**Transmit:** to pass along. When a material transmits sound waves, it keeps them going!

**Reflect:** to bounce back. When sound waves run into certain materials, they bounce right back off the material in a new direction.



**Porous:** full of holes that liquids or air can pass through easily. For example, a piece of foam is porous because it contains many small holes that are full of air.

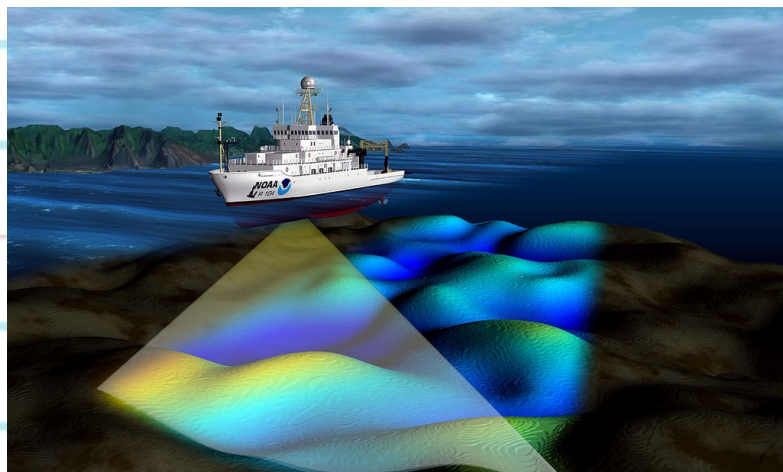
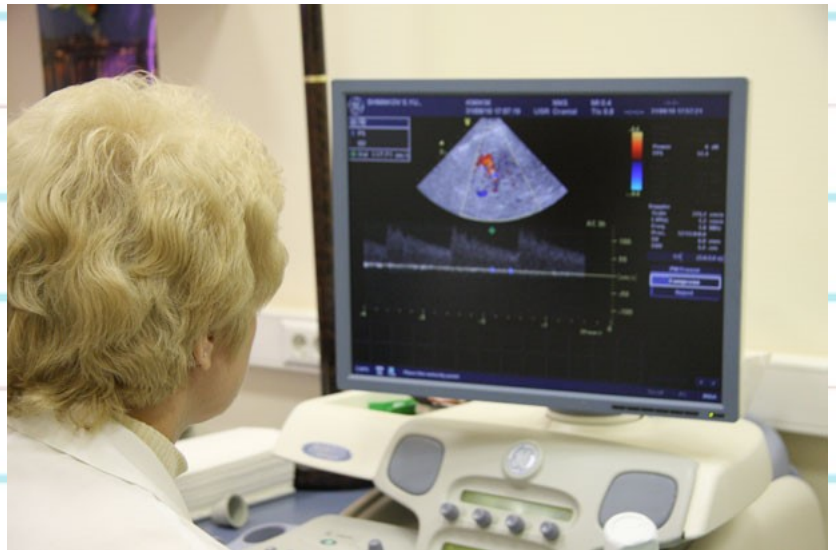
**Amplify:** to increase a sound's volume





**Acoustics:** the properties or qualities of a room or building that determine how sound is transmitted in it; relating to the science of sound.

**Ultrasound:** sound waves of a certain frequency that can be used in the medical field to create images of the inside of a patient's body



**Sonar:** a system that emits sound waves and measuring their reflection in order to detect objects underwater