

Tube Zither

Category: Physics: Sound & Waves

Type: Make & Take

Rough Parts List:

1	Cardboard tube around 1.5" works well
1	6' 40 lb test fishing line
4	1" Wood screws
4	Small eye screws
12	Small wood pieces

Tools List:

Drill
Hot glue gun
Wood file
Pencil

Video: <http://youtu.be/KK0Z1Xw-kKE>

Blog Link: www.oaklanddiscovery.blogspot.com

How To:



Use an object like a wooden block to draw a ring around the tube about 1.5" high.



Use a straight edge to draw four parallel lines about an inch apart along the length of the tube.



Drill a hole along the ring at each point where the parallel lines intersect it. Drill another hole along each of the parallel lines. Drill the holes at different heights so the strings will be of different lengths and produce different notes.

Hot glue small pieces of wood behind each hole to hold the screws more securely.



Twist the eye screws into the holes around the ring, and twist the wood screws into the holes drilled at different heights.

Tie fishing line between each eye screw and each wood screw. File a groove down the centers of four small pieces of wood and hot glue them to the tube under each string. These are the bridges.

Fine Points:

- A door jamb makes a great straight edge to work with.
- Tie the strings to the eye screws before screwing them all the way in. This will help tighten the strings.
- Tighten or loosen the eye screws to tune the instrument. Tune the instrument to actual notes by using a piano.
- Move the bridges around or change the string lengths as needed to create a specific note.

Concepts Involved:

- Sound travels in waves.
- The pitch of a sound is determined by the frequency of the sound waves.
- The frequency of the vibration is determined by the length, tightness, and width of the string.

Focus Questions:

1. Which string length produces the highest pitch? The lowest pitch?
2. Try restringing the canjo with lighter or heavier test fishing line. Does the sound change? How?
3. Would the tube zither sound different with a wooden tube? What about a plastic tube?

Elaboration:

A tube zither is a stringed instrument found in Southeast Asia and the South Pacific. In Japan they are called “kotos” and are traditionally made of bamboo. The strings are plucked to create different notes and sounds. Tube zithers are part of the larger zither family of stringed instruments. Other zithers might have a body that is a bar, bow, or flat stick.

When the string is plucked on a zither, sound is created. Sound is made up of vibrations that travel through the air or other elastic medium (such as water or steel) in waves. When the vibrations reach a person’s ear, the eardrum vibrates too and it registers to the brain as sound. Things that vibrate slowly create low notes because the sound waves are longer and have a lower frequency, while things that vibrate quickly produce high-pitched notes because the sound waves are shorter and have a higher frequency. In general, things that are shorter, tighter, and thinner create higher frequencies. This is noticeable on the tube zither; shorter, tighter, and thinner fishing line will create high notes. Use thicker, longer, and looser fishing line to create low notes. The density of material also affects pitch. Using a dense, metal tube for the zither might produce lower frequencies and lower notes. Try it!

Links to k-12 CA Content Standards:

Grades k-8 Standard Set Investigation and Experimentation:

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:

- 1.0 Students make decisions about how to approach problems:
 - 1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
 - 1.2 Determine when and how to break a problem into simpler parts.
- 2.0 Students use strategies, skills, and concepts in finding solutions:
 - 1.1 Use estimation to verify the reasonableness of calculated results.
 - 1.2 2.2 Apply strategies and results from simpler problems to more complex problems.
 - 1.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
 - 2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.
- 3.0 Students move beyond a particular problem by generalizing to other situations:
 - 3.1 Evaluate the reasonableness of the solution in the context of the original situation.
 - 3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
 - 3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Grade 2 Standard Set 1. Physical Sciences:

1.g Students know sound is made by vibrating objects and can describe its pitch and volume.

Grade 3 Standard Set 1. Physical Sciences:

1.d Students know energy can be carried from one place to another by waves, such as water waves and sound waves, by electric current, and by moving objects.

Grades 9-12 Standard Set 4. Waves:

4.a Students know waves carry energy from one place to another.

4.d Students know sound is a longitudinal waves whose speed depends on the properties of the medium in which it propagates.