

Metallophone

Category: Physics: Sound & Vibrations

Type: Make & Take

Rough Parts List:

4-7	Metal pipes, 1" apart in length, shortest around 5"
1	Baseboard, at least 3/4" thick
10-16	Double headed nails (used for concrete forms)
2	Dowels
2	Nuts that will fit the dowels tightly
20+	Rubber bands

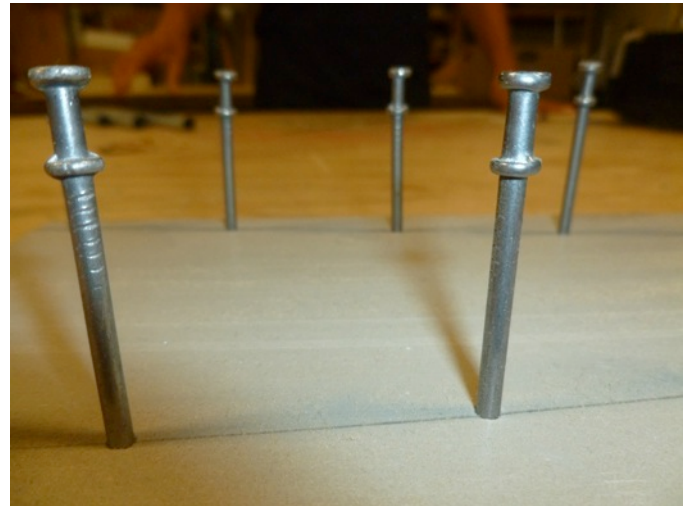
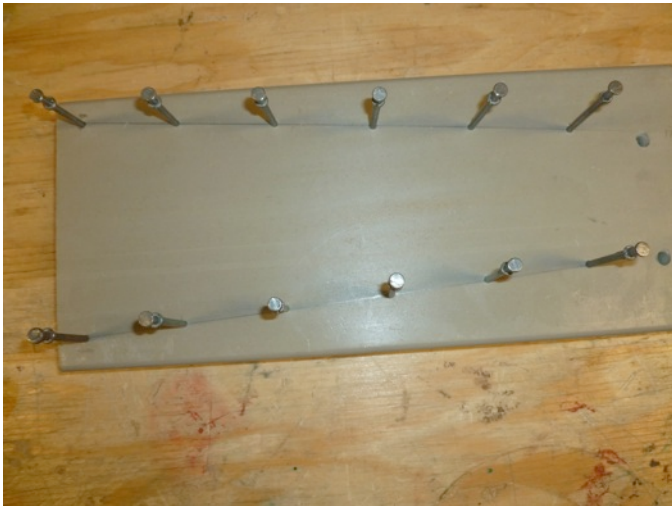


Tools List:

Hammer
Glue gun
Drill
Drill bit (a bit larger than the dowels)

Video: <http://youtu.be/tHYfgIcsBx4>

How To:

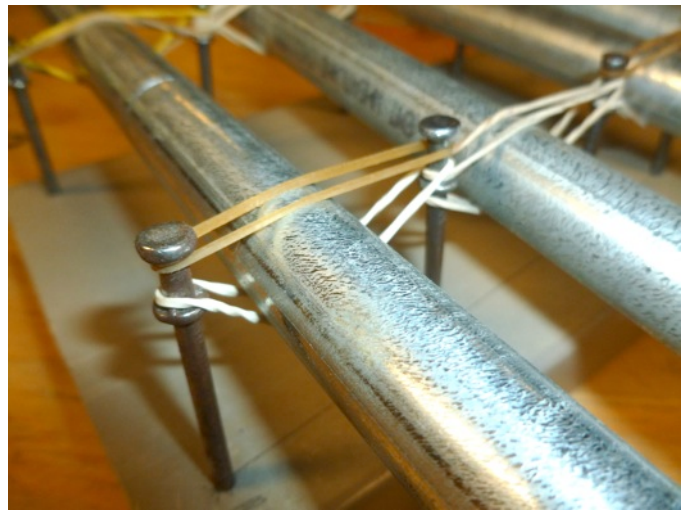


Hammer two diagonal lines of nails into the baseboard. They should be far enough apart that a metal pipe can fit between them without touching the nails.

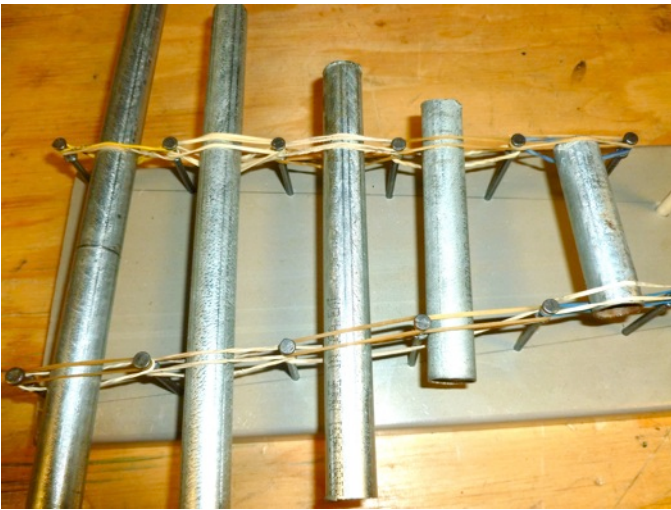
Hammer the nails so they stand at the same height.



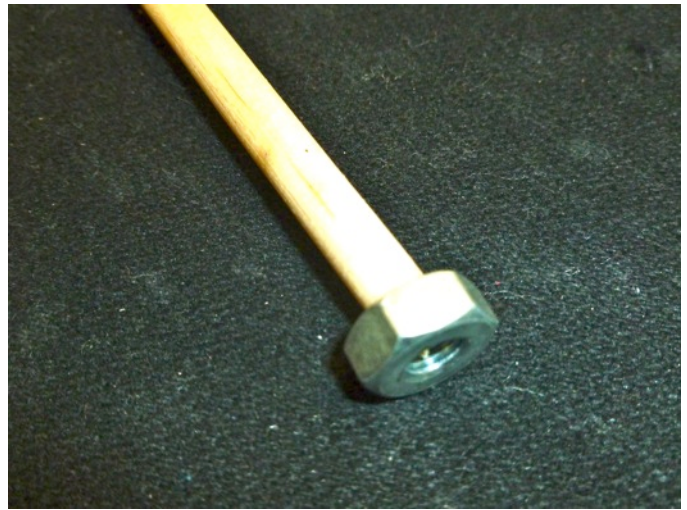
Drill two holes into the end of the board.



Wrap two rubber bands between nails.
Slide a pipe between the two rubber bands.



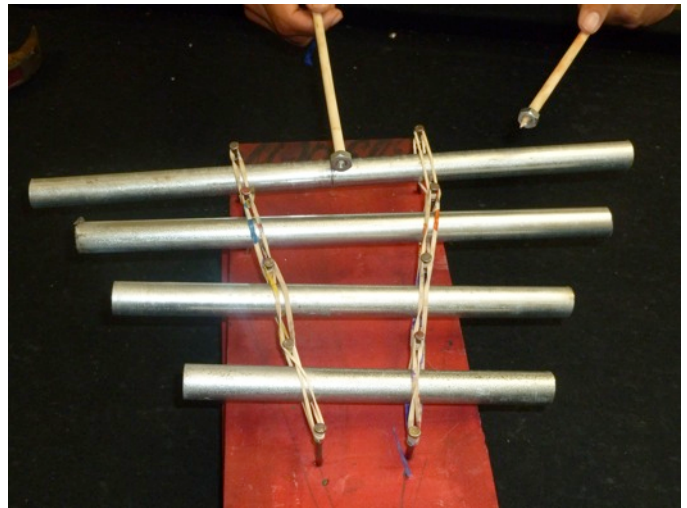
String the pipes from longest to shortest.



Twist a nut onto the end of each dowel to create two mallets, it may help to sharpen the dowel.



Push the dowels into the holes in the baseboard.



Tap the mallets against the pipes to play music!



There are many combinations and possibilities to play with! The one on the left has a small box that increases the sound.

Fine Points:

- Use pieces of wood instead of pipe to make a xylophone.
- Do not hammer nails too close to the edge of the wood base or it may split.
- The nails must be sturdy before attaching the rubber bands and pipes.
- The pipes should be evenly spread apart.

Concepts Involved:

- Sound is produced by vibration.
- When vibration is fast it produces a high note; when it is slow it produces a low note.
- Different lengths of pipes will create different sounds.

Focus Questions:

1. Where do you think sound comes from?
2. What part of this instrument is vibrating to create music?
3. How do you think we hear sound?

Elaboration:

Sound is created by vibrations and can be manipulated in two ways. Changing the speed of vibration will affect the pitch or frequency of sound; changing how big the vibration is will affect volume or loudness. You can think about how to change the vibrations on the metallophone in each of these two ways: making a higher or lower sound, and making a quieter or louder sound.

When the metal pipes are struck, they vibrate and produce sound. Supporting the pipes with rubber bands allows the pipes to vibrate more. The pitch varies between each of the individual metal pieces because of their differences in length. Long objects generally correspond with lower frequencies, while shorter objects correspond with a higher pitch.

The pipes vibrate a lot at the ends and also a lot in the middle. There are two places about $\frac{1}{4}$ of the pipe's length from each end that don't vibrate much at all. These points are called nodes. If the pipe is supported from the nodes, it will ring loud and long, since the rubber bands are not interfering with the vibrations. If the pipes are supported from the center or the ends, the support will kill the vibrations rapidly. This can be demonstrated by pinching one end of a pipe and striking it with the mallet.

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

The motion of objects can be observed and measured.

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

Grade 3 Standard Set 1. Physical Sciences (Energy & Matter):

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.