

Educational Innovations[®]

SNG-100 / SNG-300 Singing Rod

When a long metal rod is held in its center with one hand and stroked with the other, a high-pitched sound is produced.

- Materials:**
- Crushed Rosin
 - Singing Rod, 24 inch (61 cm) aluminum rod: #SNG-100
or
 - Singing Rod - Three Tone Set - 24, 30, 36 inch (61, 76, 91 cm): #SNG-300

Procedure A:

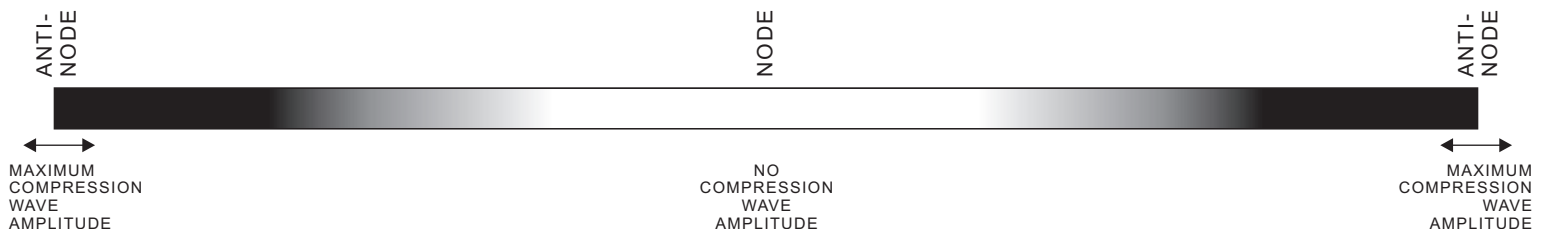
1. Firmly hold the center of the aluminum rod horizontally using the thumb and forefinger of one hand.
2. Pinch and release a small amount of crushed rosin with the thumb and forefinger of the other hand.
3. Using your rosin-coated thumb and forefinger gently stroke the aluminum rod from the center to the end of the rod. Repeat this using slightly increased pressure until you hear a high-pitched tone. Too little pressure will not set up vibrations in the rod; too much pressure will dampen the sound. It takes practice!

Procedure B:

1. Firmly hold the aluminum rod vertically at a point that is 1/4 the distance from the upper end.
2. Repeat Steps 2 and 3 in Procedure A until you hear a different pitched tone.

Explanation:

Every material has a set of natural vibrations. When you hold the aluminum rod in its center and stroke it with rosin-coated fingers, your fingers ‘stick-slip’ as they slide along the rod. This causes the rod to start moving (lengthwise) with one of its natural vibration frequencies - a half-wave tone. As you continue to stroke the rod, the vibrations increase and the loudness increases. The node is a place on the rod that is not moving. An anti-node is a place on the rod with maximum vibration. Touching a node will not dampen the sound; touching an anti-node will.



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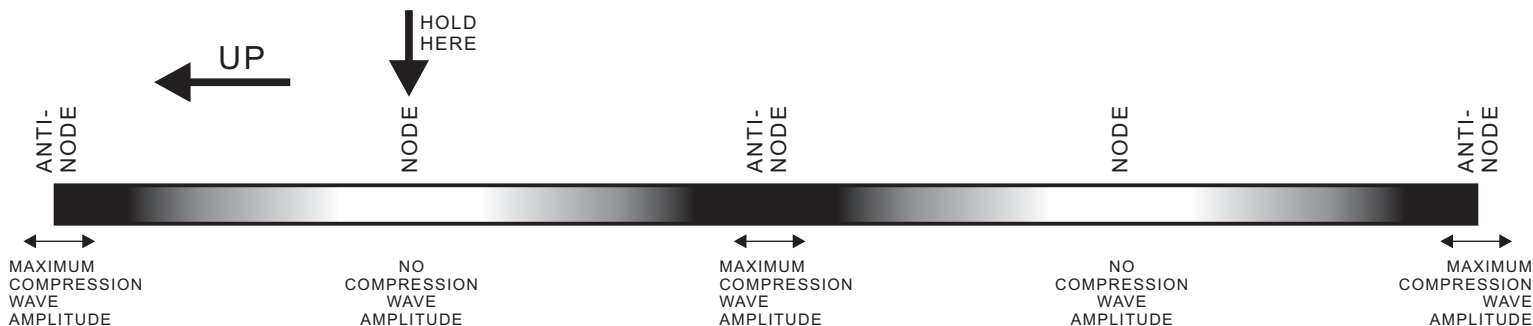
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You can calculate the frequency of the note you are hearing by dividing the velocity of sound in the rod (~ 5100 m/s for aluminum) by the wavelength which is twice the length of the rod (remember: a rod held in the center vibrates at its half wave frequency). For the 24 inch aluminum rod, this frequency is about 4200 cycles per second (Hz).

$$\text{FREQUENCY} = \frac{\text{VELOCITY}}{\text{WAVELENGTH}} = \frac{5100 \text{ m/s}}{2 \times 0.61 \text{ m}} \approx 4200 \text{ Hz}$$

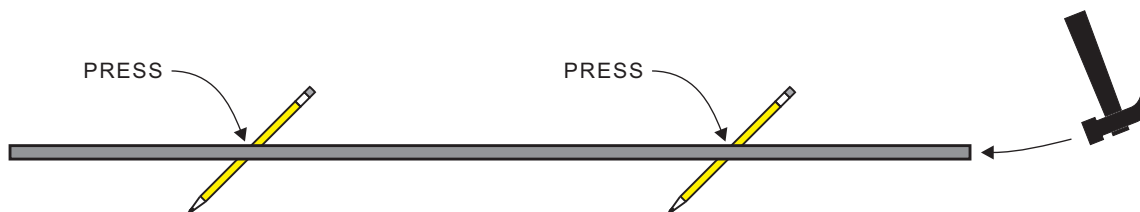
Holding the rod (vertically) at a point one quarter wavelength from its end will produce a higher pitched sound: for the 24 inch rod the full wave tone will be about 8400 Hz.



While holding the rod at the top quarter wave node, touch the lower node and notice that the sound is not dampened.

Things to Try:

1. Clamp the singing rod to a table at one of the nodes, allowing the remainder of the rod free movement. Stroke the rod and note the difference.
2. Hold the rod vertically and drop it a few cm onto a hard surface. Then, while holding the rod in the center, hit the rod's side near its end using a hammer. Compare the sounds. Which sound is the same as stroking the rod?
3. Try holding the rod at different places while stroking.
4. When the rod is 'singing', where is the sound the loudest - at the ends or off the sides?
5. Balance the rod on pencils placed at the 1/4 and 3/4 points of the rod. While using fingers to apply pressure on the rod at the points above the pencils, ask someone to gently hit the end of the rod with a hard object such as a small hammer. How does the sound change when you move the positions of the pencils?



National Science Education Standards

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| K-4 | ! | Employ simple equipment and tools to gather data and extend the senses (Standard A. 1.3) |
| | ! | Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration (Standard B. 2.4) |
| 5-8 | ! | Energy is a property of many substances and is associated with sound (Standard B. 3.1) |
| 9-12 | ! | Waves, including sound, have energy and can transfer energy when they interact with matter (Standard B. 6.1) |