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Educational Innovations, Inc.®

Singing Rod

SNG-100 / 300

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

Elementary / Middle School Experiments:

Materials:

Crushed Rosin
Singing Rod, 24-inch (61 cm) aluminum rod
Singing Rod – Three Tone Set - 24, 30, 36-inch (61, 76, 91 cm)

Procedure A:

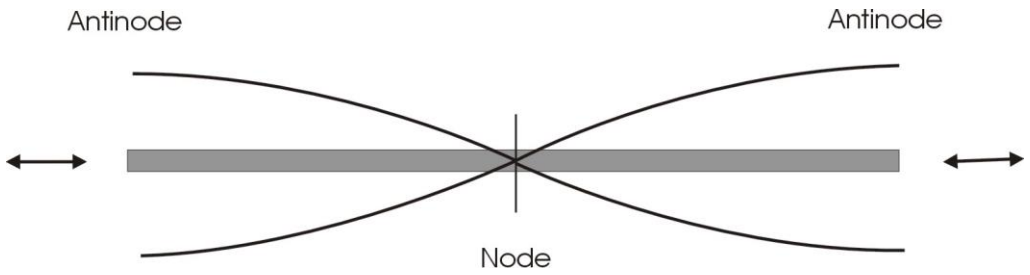
1. Firmly hold the center of the aluminum rod horizontally using the thumb and forefinger of one hand.
2. Pinch and release a small amount of crushed rosin with the thumb and forefinger of the other hand.
3. Gently stroke the aluminum rod from the center to the end of the rod using your rosin coated thumb and forefinger. Repeat and slightly increase the pressure of your stroking hand 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 ¼ 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 the center and stroke it with rosin coated fingers, your fingers slip and stick as they slide along the rod. This causes the rod to start moving with one of its natural frequencies of vibration – 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 object that is not moving. An anti-node is a place on the object with maximum vibration. Touching a node will not dampen the sound; touching an anti-node will.



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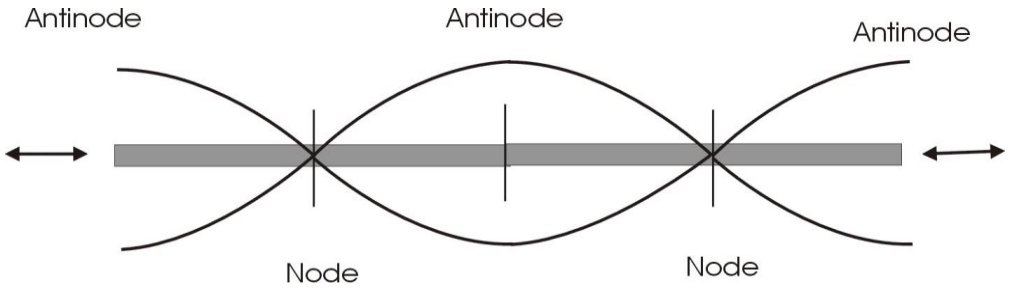
Explanation
continued

Note: Stroking the rod produces a compression wave within the aluminum in the direction of the arrows. A transverse wave is drawn for simplicity of representation.

You can calculate the frequency of the note you are hearing by dividing the velocity of sound in the rod (ca. 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 a half-wave frequency). For the 24-inch aluminum rod, the frequency is about 4200 cycles per sec or Hz.

Frequency = velocity / wavelength = (5100 m/s) / (2 x .61 m) = 4200 Hz

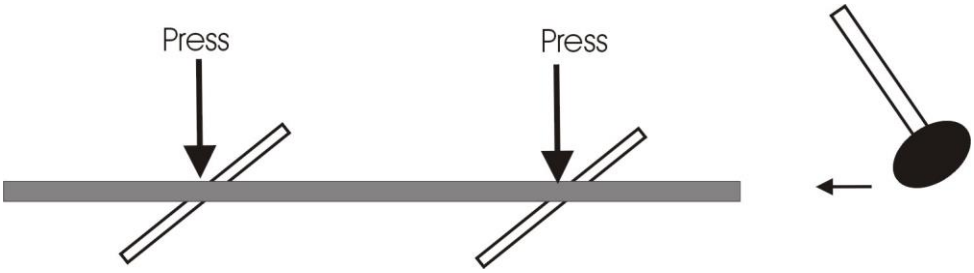
Holding the rod at a point from the end that is a quarter of its length will produce a higher pitched sound, a full-wave tone, about 8400 Hz.



While holding the rod at one node, touch the other 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 notice 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 side near the end with 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 the side?
5. Balance the rod on pencils, placed at the ¼ and the ¾ 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 position of the pencils?



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To extend your lesson, consider these Educational Innovations products:

Sound Tubes (SS-600)

Sound Tubes are our absolute favorite sound toy. When spun in a circular motion, these tubes produce a tone. As the Sound Tubes are spun faster, the tone steps up in frequency. Due to the harmonics of the tube, there is not a gradual increase in frequency. Use these with our Wave Modeling Spring for a fantastic standing wave demonstration.

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This 6-foot-long spring stretches to over 30 feet! Perfect for modeling standing and moving transverse waves as well as moving sound waves. Demonstrate the relationship between wavelength and frequency in a way your students will never forget.

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