15845 Singing Rods

Purpose:

To demonstrate standing waves in a metal rod, beats between two sound sources, and the speed of sound in an aluminum alloy.

Background:

The piercing sound made by stroking a metal bar with rosin-coated finger tips is well known. When a rod is held between finger tips at the midpoint, a vibrational node is forced there. When the rod is excited by stroking, tapping, or pounding one end, a standing wave is formed, and the wavelength in the metal bar is just twice the length of the bar.

It will be noticed that the frequency excited by pounding directly on the end is the same as that for stroking. Both of these excite longitudinal vibrations. The frequency for tapping the side of the end as though it were a chime, is not the same, so the speed of transverse waves in the metal is not the same as the speed of longitudinal waves, as can be verified in a reference table of values.

Procedure:

The demonstrator should wear the hearing protection included, and students should be cautioned to cover their ears. Holding one rod in the center, hit the end of it with a hammer or other tool. Then with rosin coated fingers, stroke the end to make the same sound, only much louder. Finally, lightly tap the side of the end with some metallic object or tool.

To demonstrate beats, hold the two rods in their respective centers, and strike the ends together (directly end on). The two rods have been carefully cut to the same length, but they do not turn out to be exactly the same, so they will vibrate with slightly different frequencies. The frequency of the beat is simply the difference between the frequencies of the two rods. A “zero” beat would mean that the frequency is the same, and is the method used for tuning many musical instruments.

Time Allocation:

To prepare this product for an experimental trial should take less than ten minutes. Actual experiments will vary with needs of students and the method of instruction, but are easily concluded within one class period.

Feedback:

If you have a question, a comment, or a suggestion that would improve this product, you may call our toll free number.