

Musical sticks

Standing waves in rods

You will need....

- ✓ Eight wooden spars or dowels ranging in length from 140 to 200 mm; wood of 10 mm × 10 mm section is very suitable

Background:

The resonant frequency of a rod is inversely proportional to square of the length; if the length is doubled the frequency drops by two octaves. To increase the frequency by one semitone the length should be reduced by about 3 % (2.93 %).

Follow these steps:

1. Cut eight wooden spars of the following lengths: 198, 192, 182, 171, 162, 157, 148 and 140 cm.
2. Ideally the pieces of wood should be as uniform as possible; however it may still be necessary to 'tune' them. Sanding the end of a stick will reduce the length and raise the pitch; sanding the middle will lower the pitch.
3. Drop the sticks onto a hard surface in order of decreasing length.

So what happened?

When only one stick is dropped it does not sound very musical. When the sticks are dropped in order of their length then the changing pitch of the notes is quite obvious. When the wood hits the floor it vibrates for a moment before coming to rest. It does not produce a pure tone but the dominant frequency is more evident when the sticks are dropped in sequence.

What next?

1. Investigate the relation between the thickness of the wood and the frequency.
2. Experiment with other materials such as metal and stone.
3. Make a xylophone: Drill two holes (2 mm diameter) in each piece of wood at a point 22.4 % from each end and arrange them in order on two strings with small spacers between them (e.g. beads or pieces of light plastic tubing).

