# Question #214

The teacup shown in the photograph at the left below can be struck lightly around its brim to create pleasant tones corresponding to standing wave vibrations of the brim of the beaker like the standing waves shown in the figure at the center below. The solid line represents the circular brim of the cup at rest, and the dashed lines represent the maximum excursion of the oscillation of the brim of the teacup after it is struck by the spoon; each "n" identifies a nodal point in the motion of the beaker brim.
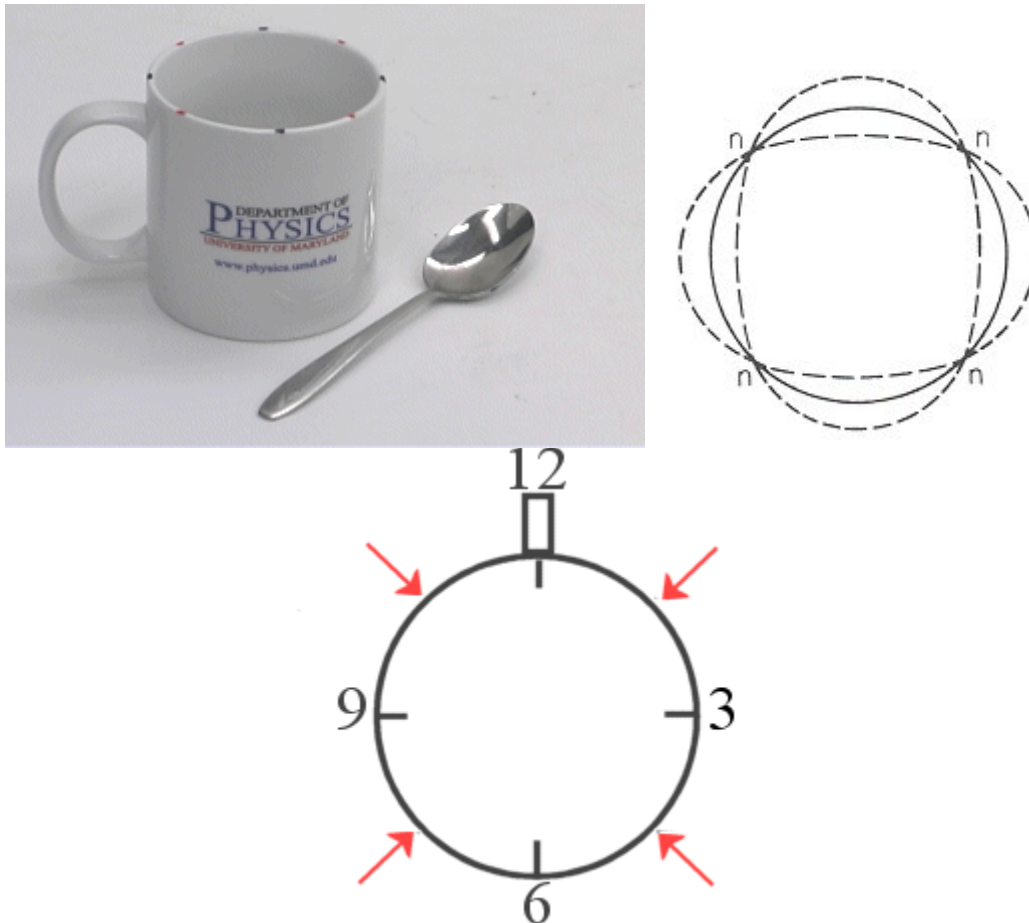
A more complete drawing of the beaker brim, showing the handle, is given at the right above, because the handle *might* have some part in how the standing wave develops. The handle is shown at "12 o'clock," and other points on the rim are labelled correspondingly by clock numerals. Arrows have been inserted at the diagonals between the four major clock numbers. The standing waves shown in the center figure above occur when the brim of the teacup is struck at the points numbered 3, 6, 9, and 12, with the nodal lines at the diagonals between these numbers. Click your mouse on the drawing at the right above to hear the tone obtained when the cup is struck at the position of the handle (marked 12 o'clock).

When the rim of the beaker is struck at the various places(the numbers and the arrows at the diagonals) indicated in the drawing at the right above, which of the following statements are true:

- (a) The tones produced by striking the brim of the beaker at 3, 6, 9, and 12 have the same frequency.

- (b) The tones produced by striking the brim of the beaker at the four arrows have the same frequency.
- (c) The tones produced by striking the brim of the beaker at all eight of these points have the same frequency.
- (d) The tones produced by striking the brim of the beaker at the numbered points are higher in frequency than those obtained when the points identified by arrows are struck.

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