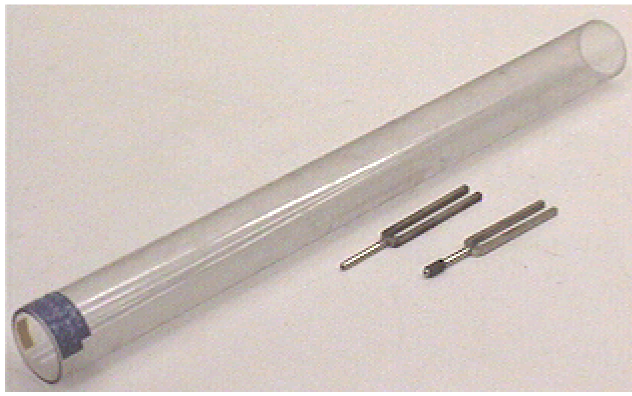
Answer #162

The answer is (b): the frequency produced by blowing across the end of the plastic tube is lower than that of the tuning fork, as can be observed on an mpeg video by clicking your mouse on the photograph above.



In fact, the frequency of the tube is one octave lower - a factor of two in frequency. The tuning fork is activating the second harmonic of the tube - twice its lowest resonant frequency.

You can calculate the resonant frequency f of the plastic tube in terms of the speed of sound s (approximately 345 m/s at room temperature) and the wavelength ○ = 2 L, where the length of the tube L = 0.68m (68 cm). Note that the fundamental wavelength is twice the length of an open tube, so:

f = s / ○
= 345 m/sec / 2 x 0.68 m
= 254 Hz,

which is somewhat higher than 240 Hz, that is half of 480 Hz. However, the antinodes of the standing wave in an air tube are not exactly at the ends of the tube, but about 0.3 times the diameter of the tube out from the ends. Adding this "end correction" (about 2 x 0.3 x 6 cm, or about 3.6 cm) the effective length of the tube is 71.6 cm, so its fundamental frequency should be about 241 Hz, considerably closer to the fundamental of the tube, 480 Hz/2 = 240 Hz, obtained from the tuning fork.

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