

## Answer #328

The answers are (a): the spacing between the harmonics will increase, and (c) the frequencies of the formant regions will remain the same. This can be seen and heard in an mpeg video by clicking your mouse on one of the two figures below, which show the wave shape and the spectrum for the "ee" sound at 100 hertz and 200 Hertz respectively.



The resonances of the nasal cavity that define the upper formant region must remain the same for one reason: the size and the shape of the cavity cannot be changed. The nasal cavity behaves acoustically as a rather complex Helmholtz resonator, creating the resonance curve defined by the envelope of the harmonics in either figure. Because the frequency of the sound increases by a factor of two, the harmonics are spaced by a factor of two in the higher "ee" sound. Because the resonance characteristics of the cavity do not change, the formants remain basically at the same frequency, and are even very similar in shape.

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