

## PhyzJob: "Kenneth, what's the frequency?"



On a Saturday night in October, 1986, at about 10:30pm, CBS anchorman Dan Rather was accosted in upper Manhattan by a well-dressed assailant who demanded an answer to a mysterious question. "Kenneth, what's the frequency?" asked the anchorman's antagonist. Rather, who had forgotten his high school physics, was perplexed and unable to offer a solution to the stranger.

You, however, *are* taking high school physics and are therefore capable of answering the assailant's riddle. *You* have the ability to mathematically describe the frequency of the  $n$ th harmonic of a standing wave in a string of a given mass and length at a certain tension. Simply follow the steps below.

1. Write the equation for the speed of a wave in a string under tension (in terms of the tension in the string, the mass of the string, and the length of the string).
2. Write the general equation for the wavelength of the  $n$ th harmonic of a string (in terms of  $n$  and the length of the string).
3. Write the equation for the frequency associated with a wave (in terms of the propagation speed of the wave and wavelength).
4. Substitute the expression for wavelength in step 2 into the expression for the frequency in step 3 to derive a general equation for the frequency of the  $n$ th harmonic (in terms of the propagation speed of the wave, the harmonic number, and the length of the string).
5. Finally, substitute the expression for the propagation speed of the wave in step 1 into the expression for  $f$  in step 4 to derive a general equation for the frequency of the  $n$ th harmonic (in terms of the tension in the string, the mass of the string, the harmonic number, and the length of the string).

5.  $n/2 \cdot \sqrt{(T/mL)}$   
You may wish to send this information on to Mr. Rather c/o CBS News, New York, NY. Rather was beaten and chased by the mugger. Special Offer: 10 CTF pts if you bring a copy of an article regarding the above incident that you found through your own research (by the end of this unit). 40 CTF pts for a personal response from Dan Rather regarding the incident and the derivation above (by the final)