Quiz 10

Choose the best answer.

1. A cylindrical pipe of length L is supporting standing sound waves. Which of the following is wrong?

   A. If it is open at both ends, there are pressure nodes at both ends.

   B. If it is closed and one end and open at the other, the frequencies of the harmonics are odd multiples of the fundamental frequency.

   ☛C. In both cases, the wavelength of the fundamental mode is $2L$. [For the pipe closed at one end, it is $4L$.]

   D. One of the above is not true.

Choose T or F depending on whether the statement is true or false.

2. If two sounds differ in intensity by a factor of 10, the difference in their loudnesses is 10 db. **T** [$\log_{10}(10) = 1$.]

3. While driving on a highway, you hear the sound of an emergency vehicle behind you, so you pull over and stop. As the vehicle approaches you, the frequency of its horn you hear is f_1. After it passes you and is moving away, the frequency of the horn you hear is f_2. Let α be the ratio of the speed of the vehicle to the speed of sound. The frequency of the horn as heard in the vehicle is f_0.

   a. Find the ratio f_1 / f_2 in terms of α.

   b. If $f_1 = 660$ Hz and $f_2 = 550$ Hz, what is α?

   c What is f_0?

a. We have $f_1 = f_0 \dfrac{1}{1-\alpha}$ and $f_2 = f_0 \dfrac{1}{1+\alpha}$, so $\dfrac{f_1}{f_2} = \dfrac{1+\alpha}{1-\alpha}$.

b. We have $\dfrac{1+\alpha}{1-\alpha} = \dfrac{6}{5}$. Solving for α, we have $\alpha = 1/11$. [About 69 mi/hr.]

c. Now $f_1 = 660 = f_0 \dfrac{1}{1-1/11} = f_0 \dfrac{11}{10}$, so $f_0 = 600$ Hz. [Can also use f_2.]