KING FAHD UNIVERSITY OF PERTOLEUM & MINERALS
PHYSICS DEPARTMENT
QUIZ #2- CHAPTER 17

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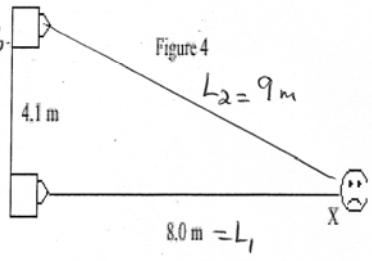
In figure 4, two small identical speakers are connected (in phase) to the same source. The speakers are 4.10 m apart and at ear level. An observer stands at X, 8.00 m in front of one speaker. Take the speed of sound to be 340 m/s.

(a)At what frequency in the audible range will the listener hear the first maximum sound?



For maximum sound $\Delta L = n\lambda$ $n = 0, 1, 2, \ldots$

$\Delta L = L_2 - L_1 = 9 - 8 = 1$ m

take $n = 1$ (First max. sound)

$$\Delta L = \lambda = \frac{v}{f}$$

$$f = \frac{v}{\Delta L} = \frac{340}{1} = \boxed{340 \text{ HZ}}$$

(b) At what frequency in the audible range will the listener hear the first minimum sound?

For minimum sound $\Delta L = n\frac{\lambda}{2}$ $n = 1, 3, 5, \ldots$

take $n = 1$ (first min. sound)

$$\Delta L = \frac{\lambda}{2} = \frac{v}{2f}$$

$$f = \frac{v}{2\Delta L} = \frac{340}{2} = \boxed{170 \text{ HZ}}$$

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(a) A certain sound source is increased in sound level by 10 dB. By what factor is its intensity increased?

$$\beta_2 = \beta_1 + 10$$

$$10 \log \frac{I_2}{I_0} = 10 \log \frac{I_1}{I_0} + 10$$

$$10 \log \frac{I_2}{I_1} = 10 \Rightarrow \log \frac{I_2}{I_1} = 1$$

$$\boxed{\frac{I_2}{I_1} = 10^1 = 10}$$

(b) At a distance r = 50 m from a sound source, the sound level is 80 dB. At what distance from the source will the sound level be 100 dB?

$$\beta_2 = \beta_1 + 20$$

$$100 = 80 + 20$$

$$\frac{I_2}{I_1} = 100 = \left(\frac{r_1}{r_2}\right)^2$$

$$r_2 = r_1 \sqrt{\frac{1}{100}} = \frac{50}{10} = \boxed{5\ m}$$

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A pipe closed at one end has two consecutive resonance frequencies of 400 Hz and 600 Hz. Take the speed of sound to be 340 m/s.

(a) What is the fundamental frequency of the pipe?

$$f_{n+2} - f_n = 2\frac{v}{4L} = 200\ Hz$$

$$f_1 = \frac{v}{4L} = \frac{200}{2} = \boxed{100\ Hz}$$

(b) What is the frequency next to 900 Hz?

$$f = 900 + 200 = \boxed{1100\ Hz}$$

(c) What is the resonant mode for this frequency (900 Hz)?

$$n = \frac{f_n}{f_1} = \frac{900}{100} = 9$$

$$\boxed{n = 9}$$