Physics 203 Ecampus

Group Quizbit | Two Source Interference

Work with your lab group to produce a single handwritten solution to the question(s) in this Quizbit. Submit a single copy of your work to Gradescope. Writing everyone's name on the handwritten copy does not associate each student with the work, be sure to add the group member's names when submitting. The clarity of communicating your reasoning, along with providing multiple representations and clearly organizing your work will be weighed more heavily than the final answer in your grade.

1. Two spherical speakers playing a 686 Hz note are positioned 6.634 meters apart directly East and West of each other. You are standing directly North of one speaker, 10 meters in front of it.

   (a) What is the wavelength of the sound?

   (b) How far are you from the other speaker?

   (c) Where you are currently standing, do you hear a relatively loud or quiet note? Explain.

   (d) You move slowly in a straight line to the East or West until you are standing equidistant (the same distance) from each speaker. How many quiet spots do you observe between the starting and ending locations?

Hints:
Path Length Difference!
$a^2 + b^2 = c^2$
$v = f\lambda$
$v_{\text{sound in air}} = 343$ m/s

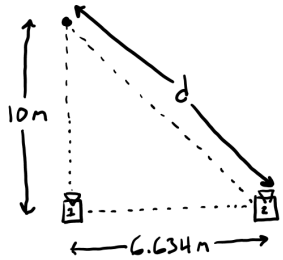
a) $v = f\lambda$

$v_{sound} = f\lambda$

$343\ m/s = (686\ \frac{1}{s})\lambda$

$\Rightarrow \lambda = \frac{1}{2}\ m$

b)



$d^2 = 10_m^2 + 6.634_m^2$

$d^2 = 144.0\ m^2$

$d = 12.0\ m$

c) Path 1 $\Rightarrow$ wave travels 10 m

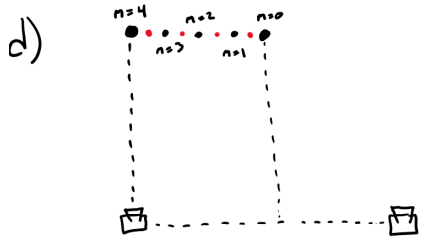
Path 2 $\Rightarrow$ wave travels 12 m

$PLD = \text{Path } 2 - \text{Path } 1 = 2\ m$

$PLD = m\lambda$, $\lambda = \frac{1}{2}\ m$, $PLD = 2\ m$ $\quad 2\ m = (m=4)(\frac{1}{2}\ m)$

Since the PLD is an even number of wavelength, the two waves are in-phase at the observation point $\Rightarrow$ constructive interference $\Rightarrow$ we hear a loud sound!

d)



From part (c), we know the starting location is the $n=4$ loud spot. In the diagram drawn above, the black spots are the $n=3,2,1$, and 0 loud spots. The $n=0$ spot is the point equidistant from the speakers. We thus see that there are four quiet spots we encounter. Between each loud spot is a quiet spot with a half-integer number of wavelengths as the PLD. $(n+\frac{1}{2})\lambda$