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

NAME: Key ID# SECTION# 16

A train approaches a mountain at a speed of 75 km/hr. The train's engineer sounds a whistle that emits a frequency of 420 Hz. What will be the frequency of the echo that the engineer hears reflected off the mountain? (The speed of sound in air = 343 m/s)

$v_s = 75$ km/h $= 20.8$ m/s

$$f' = f \frac{v}{v - v_s} = 420 \frac{343}{343 - 20.8}$$

$$f' = 447 \text{ Hz}$$

$v_o = 20.8$ m/s

$$f'' = f' \frac{v + v_o}{v} = 447 \frac{343 + 20.8}{343}$$

$$\boxed{f'' = 474 \text{ Hz}}$$

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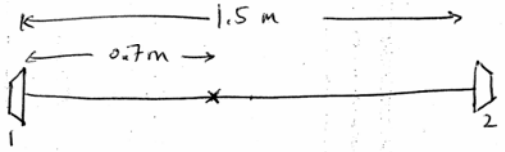
Two speakers are driven by a common oscillator and face each other at a distance of 1.500 m. A man is standing at 0.700 m from one of the speakers along the line joining the two speakers. What is the highest frequency of the oscillator, within the audible range (20.0 Hz to 20.0 kHz), so that the man hears a minimum sound? (Speed of sound = 343 m/s).



Minimum sound $\Rightarrow \Delta L = n\frac{\lambda}{2} = n\frac{v}{2f}$

$$f_n = n\frac{v}{2\Delta L}$$

$L_1 = 0.7m \quad L_2 = 1.5 - 0.7 = 0.8\ m$

$\Delta L = L_2 - L_1 = 0.1\ m$

$v = 343\ m/s$

use $f = 20{,}000$ Hz to find n

$20{,}000 = n \times \frac{343}{2\times 0.1} \Rightarrow n = 11.7$ $\boxed{n = 11}$

Highest frequency $\Rightarrow$ $f_{11} = 11 \times \frac{343}{2\times 0.1} = \boxed{18865\ Hz}$

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NAME: Key ID# SECTION# 18

Consider a pipe closed at on end. Two successive frequencies of the pipe, filled by air, are 500 Hz and 700 Hz. What is the length of the pipe? [speed of sound in air = 340 m/s].

$$f_n = 500\ Hz = n\frac{v}{4L} \quad -(1)$$

$$f_{n+2} = 700\ Hz = (n+2)\frac{v}{4L} \quad -(2)$$

$$(2) - (1) = \frac{2v}{4L} = 200$$

$$\frac{340}{2L} = 200 \Rightarrow L = \frac{340}{400} = \boxed{0.85\ m}$$